Longbow 2

Written by Tuesday Frase and Chris McCubbin

Additional writing by Jennifer Spohrer

Edited by David Ladyman

Design and Layout by ORIGIN Creative Services

ORIGIN Systems, Inc.

5918 West Courtyard Drive

Austin, Texas 78730

HOW TO USE

This manual is subdivided into eight chapters. Some (0, 1 and 2) describe how to play the game, others (3, 6, 7 and Appendices) contain reference information, and others (4 and 5) contain both.

At the beginning of each chapter, you'll find a detailed table of contents. Page references include the chapter and page number — p. 3.12, for example, refers to Chapter 3, page 12. The appendices at the end of the book give glossary and acronym information, a bibliography and useful flight charts.

SHADED TEXT	Text in a **light-gray box** denotes additional information. Although useful, this info is not required to play the game.

QUICK START	For a quick game overview and fundamental keystokes, see the back inside cover of this manual.
0. INTRODUCTION	**How to Use** (this section) tells you how to find the information you need in this book. A detailed table of contents follows.
	Table of Contents (p. 0.6 - 0.11) gives a chapter by chapter listing of contents for this manual. More detailed listings appear at the beginning of each chapter.
	In a Hurry? (p. 0.12 - 0.16) describes how to start an Instant Action mission and explains basic keystrokes to get you up in the air and firing your weapons.
1. ON THE BASE	**On the Base** describes the functionality of all buildings on the base, as well as how to use the training missions, Jane's object viewer, and mission planner.
2. COCKPIT/SYSTEMS	**Aircraft Overview (p. 2.3)** introduces the three flyable helicopters and briefly describes the helicopters' main display systems and **Master Modes (p. 2.9)**.
	Integrated Helmet and Display Sighting System (p. 2.12) and **IHADSS Flight Symbology (p. 2.14)** cover the four IHADSS modes and define each item you see in the Longbow's cockpit display.
	Multi-Function Displays (p. 2.24) takes you through all MFD pages for all helicopter types and explains the items that appear in them.
	In-Flight Navigation System (p. 2.44) discusses the game's dynamic, in-flight mission planning map, and **Kiowa Digital Moving Map (p. 2.45)** covers the Kiowa Warrior's scrolling map display.

7. JANE'S — **Jane's Specifications (p. 7.1)** lists actual specifications and photographs from Jane's Information Group for all three flyable helicopters, their weapons and major avionic systems.

APPENDICES — **Appendices** provide useful lists and glossary information:

Appendix A — ***Longbow vs. Longbow 2*** **(p. A.1)** gives veteran players an idea of what new, major features to expect in *Longbow 2*, and describes where to find specifics on each element.

Appendix B — **Acronyms (p. B.1)** explains commonly used acronyms.

Appendix C — **Glossary (p. C.1)** defines commonly used aircraft, ground vehicles and military terms.

Appendix D — **Flight Charts (p. D.1)** lists cruise velocity and autorotational landing charts for the Longbow Apache, Black Hawk and Kiowa Warrior.

Appendix E — **Bibliography (p. E.1)** lists the references used in preparing the game and the manual.

0. INTRODUCTION / IN A HURRY?

For a three-page Quick Start, please see the back cover and inside back cover on this manual.

1. ON THE BASE

2. COCKPIT/SYSTEMS

3. GROUND SCHOOL

4. FLIGHT TRAINING

5. COMBAT

6. CAMPAIGNS

7. SPECIFICATIONS

APPENDICES

IN A HURRY?

This section assumes that you selected a **CASUAL** installation. If you selected **EXPERT**, you can change the game's settings in the **OPTION** menu.

1. Press Alt O
2. Select **CONTROLS**, then **CASUAL**. Press **ACCEPT**.
3. Select **GAMEPLAY**, then **ARCADE**. Press **ACCEPT** twice to close the options screen.

This section is for new pilots who want a basic introduction to the game, as well as for seasoned pilots who only want enough information to get the game started.

Instant Action encounters don't affect your pilot's record, but they're a great way to ease into the game before starting an actual campaign.

Check out the **Quick Start Reference Card** on the back cover/inside back cover of this manual for basic keystrokes.

Page numbers in parentheses indicate where to go in the manual for more details.

Starting the Game

1. Ensure that your input devices are calibrated in *Windows 95*. If you have any questions or problems, please refer to the *Install Guide*.
2. Double-left click on the *Longbow 2* icon, or left-click the ***Start*** button and select ***Programs/Jane's Combat Simulations/AH64D Longbow 2/Longbow 2***

- Once the game starts, you'll see an overhead view of the base. Right-click the mouse anywhere to display all the hotspots.
- Left-click on the grounded helicopter (in front of the Campaign hangar) to start an INSTANT ACTION mission.

Instant Action Mission Parameters

Instant Action mission mode places you in the pilot's seat of an AH-64D Longbow Apache. (A second cockpit, the co-pilot/gunner's seat, is available as well. This front seat is usually used for targeting and weapon functions. See p. 2.51 for details.)

- **Terrain.** You'll fly in whichever map was last decompressed (NTC or Iran).
- **Helicopter/Weapon.** You'll fly an invulnerable AH-64D Longbow Apache, with unlimited weaponry (M230 chain gun rounds, RF Hellfire missiles, FFAR rockets and Stinger ATA missiles).
- **Flight Model.** SIMPLE flight mode is active. You can increase difficulty by activating the **OPTIONS** menu (press Alt O), then selecting a different flight model from the **GAMEPLAY** menu. You can also adjust **REALISM** options that change the characteristics of your chopper and/or weapons.

- **Forces.** You'll face a slew of random air and ground enemies — SAMs, helicopters, anti-aircraft guns, tanks, trucks, etc. Some will be friendly, so you may want to spend some time watching the ground battles below.

  Keeping your targets straight won't be a problem — you aren't allowed to target friendlies with this control type. To track target positions, use the in-flight mission planner map ([Alt][N]).

Flight Basics (pp. 4.1-7)

This section covers basic keystrokes you need for survival, as does the **Quick Start Reference Card** on the back cover of this manual. See the rest of the manual or the *Reference Card* for a complete listing of keys and game functions.

Basic Flight Controls

All helicopters have three basic controls:

- The ***collective*** adjusts vertical velocity (altitude), and can be set from 0-100%.
- The ***cyclic*** controls forward, sideways and backward movement.
- The ***directional control pedals*** change heading by swinging the tail rotor left or right (most useful at slow speeds).

COLLECTIVE	[+=] / [-_] or throttle wheel	Increase/decrease vertical velocity (**altitude**).
CYCLIC	[↑] / [↓]	**Pitch** helicopter down (to move forward)/up (to move backward)
	[←] / [→] or joystick	**Bank** helicopter left/right
PEDALS	[,] / [.] or pedals	**Rotate** tail rotor left/right

Takeoff Keys

Takeoff is automatic in Instant Action missions. For specific details on how to take off in other mission types, see **Flight Training: Practice Flight**, p. 4.8.

Navigation Keys (p. 2.44, p. 4.5)

[A] Activate **autopilot** (key cycles through MAINTAIN HEADING (AP1), FOLLOW WAYPOINTS (AP2) and OFF (NONE).

[H] Activate **hover hold** (must be flying slower than 15 knots, or be in autopilot mode)

[Tab] Cycle through **time compression** (2x, 4x, 8x)

[Shift][Tab] Restore normal **time**

[Alt][N] Open **mission planner**

Targeting Keys (pp. 5.10-12)

In the Longbow Apache, the square multi-function display (MFD) on the right side of the dashboard is your Tactical Situation Display (TSD). Small icons are potential targets, and an icon with a diamond represents the current target. Other MFDs exist — the types and locations vary by helicopter type. (See **Cockpit/Systems**, p. 2.1, for details.)

[T] **Target next enemy** object

Targets have the following TSD icons:


Light Structure


Light Armor


Light Wheeled Vehicle


Light Artillery


Airplane


Ground Threat (ASE)


Heavy Structure


Heavy Armor


Heavy Wheeled Vehicle


Heavy Artillery


Helicopter


Out-of-Range

Note: *The icons change if* REALISTIC FCR SYMBOLS *is active. See the* Options Menu *in the* Install Guide *for details.*

Weapon Keys (pp. 5.13-19)

 **Target Reticle**

 **Rocket I-Beam Constraint**

 **ATA Constraint**

 Hellfire Constraint

The weapon constraint indicator is a square, circle or I-beam, depending on the active weapon and helicopter type. Line it up with the target reticle (small, dashed cross hairs that appear over a target in view). When the constraint border turns from dashed to solid, you have a VALID LOCK and can fire. (If you can't fire, messages will appear on your screen — see **Weapon Inhibit Field**, p. 5.20.)

[Bksp] Switch **active weapon** to Hellfires/FFARs/Stingers
(On the Longbow Apache, the M230 Chain Gun is always active.)

[Enter] **Fire cannon (M230 Chain Gun)**

[Spacebar] **Fire rocket/missile**

View Controls (p. 2.56)

[F1] **Front cockpit** view

[Shift][F1] **Front view, no cockpit**

[F4] **Virtual cockpit** view (pannable; use [Alt] + joystick to slew view)

[F6] **Next object** view (pannable)

[F7] **Next target** view (pannable)

View Panning and Zooming

You can pan/zoom the [F4], [F6] and [F7] views. [Alt] + joystick also pans these views.

[5] (numpad) **Reset** view to center position

[8] (numpad) **Pan view up**

[2] (numpad) **Pan view down**

[6] (numpad) **Pan view right**

[4] (numpad) **Pan view left**

[+] (numpad) **Zoom in**

[−] (numpad) **Zoom out**

Ending the Mission

Pause or exit the mission/game with these keys:

[Alt][P] **Pause** the game

[Alt][Q] **Quit** the mission

[Alt][X] **Exit** to Operating System

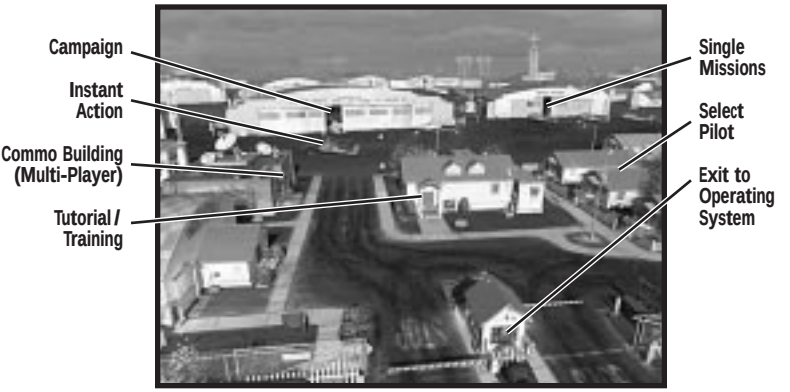
Useful Hints

- In all three helicopter types, stay low to avoid detection. Follow the terrain, flying at a low altitude and speed (below 70 knots). Most importantly, try to mask your position as long as possible by hiding behind hills or structures, or in valleys. Only pop up when you absolutely need to.
- When SAMs approach your aircraft, reduce altitude as quickly as you can without hitting the ground. This will help decrease your chances of being hit.
- Try sticking with the Longbow Apache and radar Hellfire missiles until you've got the hang of the game. They'll let you stay far enough away from your targets to take advantage of LOAL missile launch mode and reduce your exposure to enemy fire.
- Kill the AAA threats that have the longest ranges first when entering enemy territory. This makes it easier to maneuver around other threats with shorter ranges. Keep an eye on your ASE MFD and weave around the arced firing ranges of the remaining SAMs and AAA.
- Focus on mission objectives before you worry about other enemies. You'll almost always need to hit a few threats along the way — just make sure you reserve enough weapons to destroy your primary objectives. You can use any remaining ammo to hit stray targets on the way back.
- You aren't required to fly missions along pre-set waypoints. If you can identify a path with less resistance, try moving your waypoints. Keep in mind, however, that you'll need to have ample fuel to return through an alternate route.
- Listen to your CPG. He'll tell you what's out there, and where.
- To identify nearby targets, press [U]. This toggles on target identification, which shows identifying names in the UPFRONT display as you switch targets.
- If you suspect that you'll face enemy helicopters in an area, clear out a section of SAMs near the anticipated area of engagement. This way, you'll have room to climb and evade the helos without being tagged by a SAM.
- If you become disoriented when dodging fire and think you may crash, quickly press [A] so that the game's autopilot function will restore level flight. As soon as your altitude and bearing become stable, continue the fight.
- Memorize the key commands for your wingman/air support/artillery strikes. Try to use your limited number of artillery strikes on concentrated SAM areas, and use the air support strikes only on AAA positions. (If you use air strikes on SAM sites, you risk having your A-10/F-16 shot down. This will subtract promotion points from your mission score.)

1
On the Base

1. ON THE BASE

The first thing you see when you start the game is an overhead view of the complex. Each building performs one or more different functions. To see what action spots are available, right-click anywhere on the screen. To access a particular building, move the cursor over it and left-click. Once you've finished exploring the Base, proceed to **Training Building**, p. 1.5, or **Flight Training**, Chapter 4.



Read Jane's

The *Jane's Military Aircraft, Vehicles and Logistics* book lists a variety of information about most objects in the game and about the Jane's organization. The information and photos that appear here come directly from Jane's Information Group, and are identical to the published versions (although some have partial entries).

Jane's reference books can be accessed from the Bunkhouse, Training Building, Commo Building, MMPC and Debriefing room.

Each tabbed section contains information about items in that category.

- To activate, highlight the red Jane's book, then left-click.

Aircraft	Displays information on helicopters and airplanes in the game.
Armour	Displays information on armored vehicles in the game.
Vehicles	Displays information on unarmored ground vehicles in the game.
Air Defense	Displays information on AA guns and SAM sites in the game.
About Jane's	Displays the title page of the Jane's book and gives information on the Jane's organization.
Close	Returns to the Base.

By using these pages, you can learn about the objects in the game.

- Left-click on the book tabs to change chapters.
- Left-click on pictures on the left page to enlarge them to full-screen view. Left-click again to return to the normal page view.
- Left-click inside either white text box to enlarge the text page. Left-click the vertical scroll bars to scroll through statistics or descriptive text. (Or, use ↑ and ↓ to scroll.) Left-click to return to the normal page.
- Left-click on the gray arrows at the bottom of either page to turn the page.
- Left-click-and-hold on the 3-D object box on the right-hand page to rotate the object. Dragging the mouse cursor rotates the object in any direction. Pressing the left and right mouse buttons simultaneously lets you control zoom. Push the mouse forward to zoom in, backward to pull back.

BUNKHOUSE

***Select Pilot* appears when this building is highlighted.**

The Bunkhouse is where all existing pilot records are stored. Each time you start the game, the pilot that you last used will be the active pilot.

Left-click on the building to see a row of lockers. Here, you can create and store six pilots (one per locker). Once a pilot is MIA (Missing In Action) or KIA (Killed In Action), he/she is no longer available, and a folded flag appears in the locker.

Note: *You must create a pilot before flying Single or Campaign Missions. Once you create/select a pilot, he/she will remain active until you create/select a different one.*

To select a different active pilot, click on his/her flight helmet.

To create a new pilot, click on a locker and it will open. Click on the notebook to select a unit and give the pilot a name and callsign. The currently selected pilot has a flight bag in place of the helmet.

Left-click on the door to exit this room and return to overhead Base view.

Creating a New Pilot

A locker with a flight bag or helmet indicates an active pilot. A locker with a folded flag means that the pilot is inactive (either missing or killed in action).

To replace a dead pilot with a new one, select the dead pilot and change the name. This will replace the pilot with a newly created one.

CHANGE UNIT

Highlight the space at the top of the spiral notebook and left-click to change your unit affiliation. You can left-click on the unit insignias to view available units and select the one you wish to join, and you can enter a nickname for your squad.

CREATE NEW PILOT

Left-click on the name of the default pilot to change the pilot's name and callsign.

You will be given a window with the current pilot's name and callsign. Left-click on the end of the name and back-space over it, then enter the name you prefer in the space. Then, press Enter. If you wish to change your callsign, Tab down to the callsign field and do the same. Repeat for your squad nickname.

When you have the name, callsign and squad name you wish, left-click on ACCEPT. Or left-click CANCEL to exit with no changes.

VIEW SQUAD DATA

Left-click on this folder to open it and view a variety of information about the performance of that pilot and the rest of his squad.

Left-click on the bottom of the folder to toggle between pages, and on the top to exit back to the locker.

The first page of Squad Data is your personal record. At the top are your name, callsign, unit and squad. The left column consists of your current rank, total number of missions flown and number successfully completed, flight hours in each of the four aircraft types, your current score (your combat activity and successes, expressed in points) and your rating vs. other pilots in your unit, expressed as a percentile. Finally, all campaigns and training missions completed by the pilot are listed. The second column shows the number of times you've fired and hit with each weapon, and rates your efficiency with it, and also shows your confirmed kills sorted by unit type.

The second page of the folder displays information about your squad. Each squad consists of 16 helicopter crews. The page displays the name of each pilot and CP/G, the type of helicopter flown by that team (your entry will dis-

play the type of helicopter flown on your most recent mission), an efficiency rating for the team, total number of kills for the team, total flight time logged.

Each pilot created is assigned a squadron of computer-generated characters upon creation. This page keeps track only of information about that computer-generated squad. It will not reflect any information about any live players you may fly with during multi-player missions.

VIEW MEDALS Left-click on the box to the left to view medals you've earned. As you progress in the campaign, you'll receive medals and campaign ribbons. Right-click in the medals screen to see the names of all of the medals.

EXIT Close the locker.

Once you create a pilot and save your progress, this pilot remains active. (Only one pilot can be active at once.) Whoever was flying the last sortie is the default pilot when you resume the game.

- Left-click on the locker door (at the left-hand side of the screen) to close the locker.
- Left-click on the door or on the active pilot's flight bag to exit the Bunkhouse. You can now fly this pilot in any mission.

Pilot Careers

Every mission you fly logs hours for the active pilot and adds points to his/her cumulative score. Single or Campaign missions all get recorded on the pilot's stat sheet. (Instant Action missions, however, do not.) If you die in any mission, the active pilot will not be available for future missions, unless you re-fly the mission and survive.

Once you've accumulated enough points, flown enough missions, or met some other condition, you'll find new ribbons and medals in your pilot's locker.

Deleting a Pilot

Once you create a pilot, that locker is occupied until the pilot is dead, captured or deleted. If you die or are captured during a mission and choose to save your progress at that point, a yellow ribbon and flag appear in the locker. The ribbon and flag remain there until you create a new pilot in that locker.

Switching the Active Pilot

To resume another pilot's career, left-click on the flight helmet of the pilot you want to use. A flight bag will appear in the top portion of the locker — left-click on it to return to the overhead Base view. Now, missions you fly will be saved to that pilot's record.

TRAINING BUILDING

***Tutorial/Training* appears when this building is highlighted.**

Before you head for the flight area, you may want to hone your piloting skills. The Training Building offers a complete, interactive tutorial that introduces you to the Longbow Apache, Kiowa Warrior, Black Hawk and helicopter flight in general.

You can access six different training modules. Three are accessed by clicking on the books on the shelf, the other three by clicking on the helicopter models suspended from the ceiling.

The *Basic Flight Training* mission introduces you to the fundamentals of combat helicopter operation. There are also specific missions for training in each of the three helicopter types (two missions — basic and advanced — for the Longbow, and one each for the Kiowa and Black Hawk). There's also a *Free Flight Gunnery Range* mission where you can sharpen your flight and weapons skills at your own pace.

VIEW FILMS Brings you to an area where you can view promotional films about the helicopters and their systems. This area also allows you to view any game cinematics you've seen.

- Left-click on the stack of films to display a list of promotional films.
- Left-click on a film name in the dialog box to load it.
- To stop a movie, left click the mouse or press Esc.

The *News Scrapbook* records cinematics as you progress through the campaign. *Jane's* displays background information on Jane's Information Group.

- Left-click on the light switch to return to the base view.

INSTANT MISSION HELICOPTER

***Instant Action* appears when this helicopter is highlighted.**

Instant Action missions are for players who want to get up in the air quickly and destroy targets. Left click on the grounded helicopter to start an Instant Action Mission (single-player) or Death Match (multi-player). For details, see **In a Hurry?** on p. 0.12.

MULTI-PLAYER MISSION BUILDING

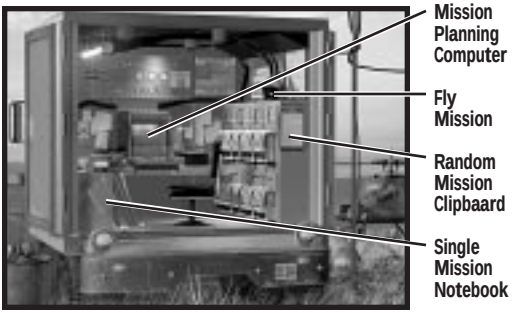
***Commo Building* appears when this building is highlighted.**

From this building you can connect to, join or organize a multi-player *Longbow 2* session. For complete instructions see the: **Multi-Player Guide.**

SINGLE MISSION BUILDING

***Single Missions* appears when this building is highlighted.**

When you enter this building you are taken to the MMPC (see p. 1.10), from which you can elect to fly any one of ten pre-generated missions, or a random mission.



When you left-click on the notebook you are given a menu of pre-generated missions from which to select.

When you left-click on the clipboard you are given a list of parameters with which to customize a random mission. You can either play a completely random situation, or pre-set the nature and difficulty of your task by adjusting the skill level of the enemy pilots (and of allied forces), the weather, the time of day, the mission type and more.

- To customize a mission, move your cursor over an option (most options default to RANDOM) and left-click to cycle through available parameters.

THEATER OF OPERATION Available options are RANDOM, WESTERN AZERBAIJAN, CENTRAL AZERBAIJAN, EASTERN AZERBAIJAN or FORT IRWIN NTC (National Training Center).

TIME OF DAY Set the mission time to RANDOM, DAY, DAWN/DUSK or NIGHT.

WEATHER Adjust the weather to RANDOM, GOOD (clear skies), FAIR (partly cloudy) or POOR (cloudy, drizzly).

WEAPONS AVAILABILITY You can limit your weapon selection by selecting RANDOM, ALLOW ALL, NO HELLFIRES, NO STINGERS and ROCKETS ONLY.

FORCE ADVANTAGE You can give one side or the other a situational advantage. Select FRIENDLY ADVANTAGE, ENEMY ADVANTAGE, NEUTRAL or RANDOM.

The remaining parameters can be set independently for both both teams.

MISSION TYPES Set the mission objective.

STRIKE (attack enemy positions behind enemy lines)

ESCORT (escort friendlies into dangerous territory)

RECON (scout enemy forces behind enemy lines)

CAP (Combat Air Patrol — engage airborne enemies)

CAS (Combat Air Support — provide air support for a friendly ground offensive)

RANDOM

SKILL LEVEL Change the skill level for computer-controlled helicopter units on both sides of the battle.

CAT III (Crack Enemies possess excellent flying skills and are difficult to kill)

CAT II (Veteran Enemies possess average flying skills and are moderately hard to kill)

CAT I (Green Enemies possess poor flying skills and are easy to kill)

RANDOM

GROUND FORCES Select LIGHT, MEDIUM, HEAVY or RANDOM for each side.

AIR DEFENSES Select LIGHT, MEDIUM, HEAVY or RANDOM for each side.

HELICOPTERS Select LIGHT, MEDIUM, HEAVY or RANDOM for each side.

AIR SUPPORT Select LIGHT, MEDIUM, HEAVY or RANDOM for each side.

ARTILLERY SUPPORT Select LIGHT, MEDIUM, HEAVY or RANDOM for each side.

- When you're finished configuring the mission, left-click ACCEPT PARAMETERS to lock in your choices, or left-click on the pencil to exit to the Clipboard. Once your parameters are set, the program then generates a random mission according to your specifications. Left-click on the Mission Planning Computer to view your mission map, briefing and to set the mission parameters. Then exit back to the MMPC and fly the mission by left-clicking on the helmet.

Details for the MMPC options appear on pp. 1.10-19.

CAMPAIGN MISSION BUILDING

***Campaign Missions* appears when this building is highlighted.**

When you left-click on this building, a plaque displays with both FALLEN CRESCENT and AZURE RUNE options. The Azure Rune training campaign has two variants. In the Friend vs. Enemy campaign, the opposing force uses authentic international arms, while in the Friend vs. Friend campaign both sides have American armaments (thereby providing a realistic context for a multiplayer, head-to-head campaign).

Select one of the options to start that campaign. (See **Chapter 6: Campaigns** for background information on both campaigns.)

To begin a new campaign:

1. Left-click on the Campaign Mission Building.
2. Select the campaign you wish to fly.

   You can have a maximum of ten saved campaign games.

   If you attempt to create a new campaign game, but already have ten campaigns in progress, a plaque will prompt you to replace one of them. Select the campaign slot you wish to replace.
3. Enter a name for your save game file.
4. Set campaign options (see below).

   You will be taken to the MMPC for your first mission briefing.

Campaign Options

Note: *For info on options specific to Multi-Player play, see the* Multi-Player Guide.

You will have to select among the following options before starting a new campaign.

CHALLENGE LEVEL Select *Easy, Average* or *Hard*.

FORCE ADVANTAGE Which side in the conflict has the numerical advantage. Select NEUTRAL, FRIENDLY ADVANTAGE or ENEMY ADVANTAGE.

CAMPAIGN LIMIT Controls the amount of game-time you are given to successfully complete the campaign. Select TWO, THREE, FOUR WEEKS or UNLIMITED.

LIMIT RADAR LONGBOWS	If this toggle is set to ON, destroyed Longbows will not be replaced immediately.
LIMIT OTHER HELICOPTERS	If this toggle is set to ON, destroyed Kiowas, Longbows without radars and Black Hawks will not be replaced immediately
LIMIT MISSILES	If this toggle is set to ON, expended Hellfires and Stingers will not be replaced immediately.
LIMIT ROCKETS	If this toggle is set to ON, expended rockets will not be replaced immediately.
ORDINANCE REPLACEMENT	Controls the speed at which missiles and rockets will be resupplied, if either is limited. Select SLOW, AVERAGE or FAST.
HELICOPTER REPLACEMENT	The rate at which destroyed helicopters will be replaced, if any of the helicopter types are limited. Select SLOW, AVERAGE or FAST.
LIMITED INTELLIGENCE	If this toggle is set to ON, the "fog of war" may prevent you from receiving accurate information about the enemy forces in your briefings.
TIME OF DAY	Select RANDOM, ALWAYS DAY or ALWAYS NIGHT.
VISIBILITY	Select RANDOM, ALWAYS GOOD or ALWAYS POOR.

Resuming a Campaign

When you restart the game and want to resume a campaign, left-click on the Campaign building. Then, left-click on the save game name that you used when you saved that campaign game.

The Campaign Mission Building will sometimes play newscasts that update you on the situation. Following that, you'll find yourself in the MMPC, where you prepare for your next mission.

See pp. 1.10-19 for details on what you can do in this area.

MOBILE MISSION PLANNING CELL (MMPC)

The MMPC is a tent or truck-mounted system used for tactical mission planning in the field. Left-clicking on either the Campaign or Single Mission Building will take you to the MMPC.

When you left-click on the notebook (after entering from the Single Mission Building) you are given a menu of pre-generated missions from which to select.

When you left-click on the clipboard (after entering from the Single Mission Building) you are given a list of parameters from which to customize a random mission.

* If in Single Mission Mode

Right-click to display text for the hotspots. You have five options in this area. When you pass the cursor over an option area, the option will highlight.

The following options are available in both Single and Campaign missions.

MISSION PLANNER — Left-click on the computer to access the Mission Planner (available only after selecting a mission).

READ JANE'S — Left-click on the Jane's book on top of the table to view statistics, pictures and text descriptions of objects in the game, just as they appear in the Jane's books.

FLY MISSION — Left-click on the green flight helmet to begin the mission (available only after selecting a mission).

TRASH MISSION — Left-click on the trash can to cancel the mission and return to the main screen for the current mission type.

Mission Planner

- Left-click on the mission planning computer on the desk to view the Mission Planner display. You can use this interface to add/delete waypoints (planned navigation points), view intelligence reports on what to expect during the mission, arm and assign your squad's helicopters, view in detail the map of the mission area, and more. You also get your briefing here (in text form).

  In addition to planning your own mission, the mission planner allows you to direct the computer-controlled flights for the rest of the helicopters in your squad.

- Each mission has a full suite of default options with which you can fly, so you never have to change anything in the mission planner.
- Left-click the red power button to close the tactical planning display and return to the Mission Planning Center. From the Mission Planning Center, left-click on the Flight Helmet to fly the mission with your current changes to the Mission Planner, or left-click on the waste basket or press Esc to trash the mission and restore defaults.
- Another name for a mission is an Air Tasking Order (ATO).

Using the mission planner gives you control over the mission, not just for your own helicopter but for an entire squadron. You can assign and arm helicopters, move or delete waypoints, and even disregard certain objectives entirely to concentrate your forces on the goals you consider most important.

Even if you have absolutely no interest in tinkering with the default mission parameters assigned by the computer, you are encouraged to at least check the briefing for any special instructions.

Menu Bars

There are four menu bars across the top of the Mission Planner Screen: System, Overlays, Map View, Waypoints. You can use them to turn certain map features on/off. Whatever options you select load the next time you use the Mission Planner.

System. This bar contains only three options, one of which is found only in multi-player games.

Exit. Closes the Mission Planner and returns you to the Mission Planning center. This option is identical in function to the red power button.

Restore All Defaults. Erases all changes to the Mission Planner and restores the computer's original defaults.

Transmit FARP Data. (**multi-player only**, see *Multi-Player Guide*) Transmits

Overlays. Toggles the various layers of the map on and off, to make it easier to notice significant details.

FARPS. Toggles FARPS on and off. FARPS (Forward-Arming And Refueling Points) are the starting points for each mission. There will usually be four FARPs per mission, each of which can launch one two-helicopter flight (Lead and Wingman). If you want to mass your forces so more than two helicopters engage any given objective, you'll have to assign a flight(s) from another FARP to rendezvous at the objective.

Friendly Units. Toggles the friendly units (blue counters) on and off.

Enemy Units. Toggles the opposing forces' units (red counters) on and off.

Air Threats. Toggles known air threats on and off. The rings around the air threat counters indicate the maximum engagement range of the threat.

Phase Lines. Toggles the Phase Line on and off. These are the imaginary lines indicating the interface between friendly-controlled and enemy-controlled territory — the battle front, if you will.

Battle Areas. The map indicates the general operation area for each mission (ATO). This option toggles those indicators off, as well as the arrow that indicates an escorted friendly's direction of advance.

5 km Grid Lines. Toggles the grid lines on the map on or off.

Map View. Controls the overall scale and appearance of the map display.

Zoom In. Zooms in on the map, until maximum magnification is reached.

Zoom Out. Zooms out until the broadest possible scale is reached.

Satellite. When this option is selected, the map appears as a satellite photo of the terrain.

Contour. When this option is selected, the map appears as a geographic contour map.

NATO Icons. When this option is selected, units on the map are displayed using standard military symbols.

Picture Icons. When this option is selected, units on the map are displayed using pictographic icons depicting their function.

Waypoints. This menu allows you to toggle the waypoints for each of the four flights on and off.

Flight 1. When this option is selected, waypoints for Flight 1 are displayed.

Flight 2. When this option is selected, waypoints for Flight 2 are displayed.

Flight 3. When this option is selected, waypoints for Flight 3 are displayed.

Flight 4. When this option is selected, waypoints for Flight 4 are displayed.

All. This option selects all flights and displays their waypoints.

None. This option de-selects all displayed flights.

TOTs. This option toggles the display of waypoint "Time On Target" numbers.

Restore Flight 1 Defaults. Restores this flight's default waypoints.

Restore Flight 2 Defaults. Restores this flight's default waypoints.

Restore Flight 3 Defaults. Restores this flight's default waypoints.

Restore Flight 4 Defaults. Restores this flight's default waypoints.

Exit. The "X" in the upper right corner closes the mission planner.

Function Buttons

Each of these five buttons activates a different planning function: Briefing, Tasking, Arming, Profiler, Rehearse.

Briefing. This button displays a (text) mission briefing. Briefing information includes general situation reports for friendly and enemy forces, specific objectives for each ATO (Air Tasking Order — in general, each task to be performed during the course of the mission), and a weather report. Click on the section headings in the left panel to view each section.

Tasking. This button allows you to assign helicopters and crew to each flight. Left-click on the colored text fields to change tasking options.

The *Inventories* box, at the top of the Tasking screen, displays the number of each type of helicopter available at each FARP, and the number of each type of weapon available for loadout (minus what is currently loaded).

Below the inventories are assignment boxes. Click on the helicopter type to display a list of available aircraft, and on the pilot and CPG boxes to display a list of available personnel.

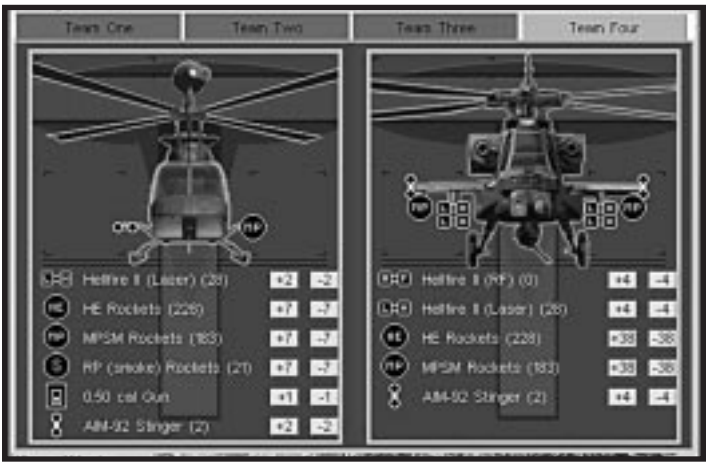
Note: *In single-player games, you must assign yourself as the pilot of a lead aircraft.*

In multi-player games, each flight must have a player lead pilot for each player wingman pilot, and each aircraft must have a player pilot for each player CP/G, before exiting the mission planner.

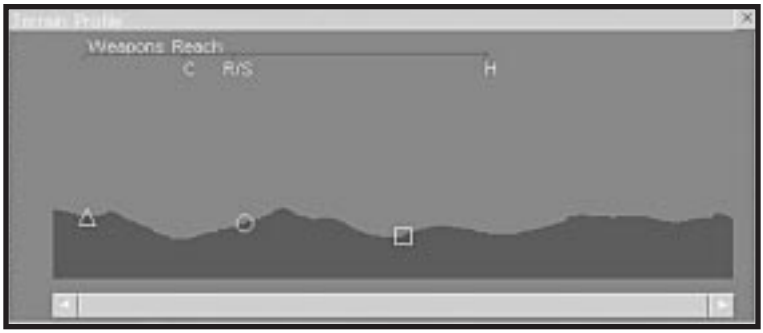
Arming. Each team window contains a graphic of the team's helicopters and all currently available armaments for those helicopters. In most missions the helicopters will be fully loaded with a computer-selected default loadout. The weapons appear as brightly colored icons on the graphic. Left-click on the "-" box in the inventory to de-select a weapon of that type. Once a space has been opened, you can left-click on the "+" box of the desired weapon on the weapons list to load a new weapon.

This function opens a window containing arming panels for each team. Left-click the top tabs to switch teams.

Helicopters do not have to be fully armed for missions. Particularly on recon missions where engaging the enemy is not part of the objectives, it may be preferable to take a lighter, partial loadout.



Profiler. This function allows you to view a vertical profile of the land along a given route.



Left-click on this button to activate the profiling tool, then left-click on any point on the map, drag to any other point and release. This will create a green line connecting the two points. A box will open, displaying the vertical contour of the land along that line. To close the profile box, left-click on the close button. You can then either draw another profile line, or left-click on the Profiler button to deactivate the profiler tool.

Rehearse. When you left-click on Rehearse, animated counters representing each flight will move along their mission path in the same relative time scale.

A control panel will appear in the menu bar, allowing you to control the speed of the rehearsal.

The *Pause, Play* and *Quit* buttons of the control panel are self-explanatory.

Time is a readout of the projected elapsed realtime from the beginning of the mission.

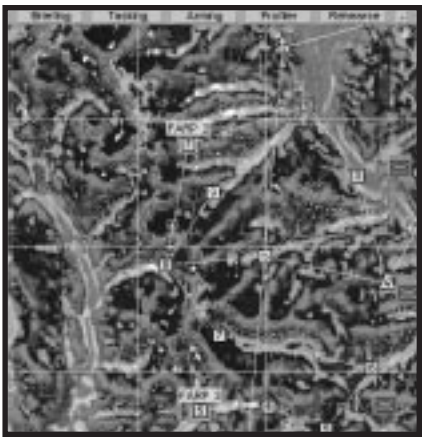
Speed controls the speed of the rehearsal. Speed can be controlled with the "+" and "-" buttons. The "+" button makes the rehearsal go faster (but less smoothly), while the "-" button slows it down.

Mission Summary Bar

The bar along the left side of the map displays a text summary of the current mission profile, sorted by FARP Teams and ATOs, including mission type, assigned aircraft and crew personnel. For a list of the various possible mission types, see **Single Mission Building**, p. 1.6. You can quickly edit your helicopter type and seat position by left-clicking on the names. However, you must use the Tasking window to check your weapons inventory.

The Map

The heart of the mission planner is the mission map itself. Most of the map functions and symbols are explained under **Menu Bars**, p. 1.11. Actions involving friendly units are represented by a blue connecting line and a blue box around the action area. Enemy units work similarly, except that the lines are yellow with crosshairs.



- Δ Recon or Strike Waypoint
- ∇ Landing Zone
- □ All other waypoints
- ◯ Line up/Release Waypoint (for escort missions)

Waypoint Symbology

If the assigned action at a waypoint involves another unit — e.g., engaging an enemy unit, or rendezvous with a friendly — a line appears connecting the waypoint with that unit.

Moving, Adding and Deleting Waypoints

The most important function of the map, other than its informational content, is its ability move, add or delete waypoints.

- You cannot move, add or delete the first waypoint, or delete the last, numbered waypoint.
- To move a waypoint, left-click and drag it to any point on the map.
- To add a waypoint, left-click on the small green box between two sequential waypoints.

Each pair of sequential waypoints in a mission has a small green box with a "+" sign somewhere along the green flight path between them.

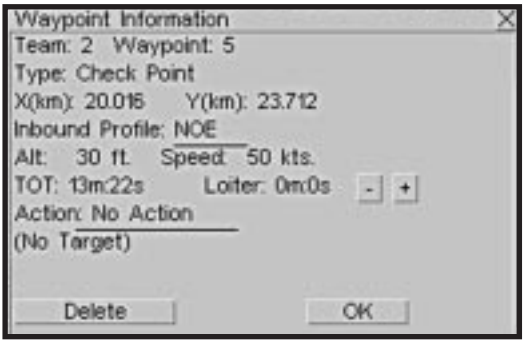
- To delete a waypoint, right-click on it to open the Waypoint Information Window, and left-click delete.

Once the new waypoint has been added, it can be moved to the precise desired position. The other waypoints will be automatically renumbered to account for the new waypoint's presence.

- Right-click on any waypoint to open an informational window about it.

Once a waypoint is deleted, the other waypoints will be automatically renumbered, and a new flight path will be drawn between the new sequential waypoints.

Waypoint Information Window



Not only does the Waypoint Information Window display useful info, it also allows you to assign new orders to new or pre-existing waypoints.

Waypoint Type. This is, broadly speaking, the reason for the waypoint's existence. The type is determined by the nature of the action assigned to the waypoint.

Checkpoint. This is simply an arbitrary geographical point at which the flight can wait, change course, or begin a new action.

Battle Point. A waypoint at which the flight is expected to engage the enemy.

Observation Point. A waypoint from which the flight may observe enemy movements.

Link-Up Point. A waypoint at which the flight is to meet other air or ground units.

Release Point. A waypoint at which the flight separates from units it has been travelling with.

Landing Zone. A waypoint where an aircraft is expected to make a landing under fire and then resume its mission.

Take-off. The starting point of the day's mission — the FARP.

Landing Point. A waypoint where an aircraft is expected to make a landing and end its mission.

X / Y coordinates. An arbitrary designation of relative position, showing the distance from the lower left corner of the Mission Map, in kilometers, along the X and Y axis.

Inbound Profile. This is the recommended elevation and speed from which to approach the waypoint. Computer controlled flights will follow this profile on approach. Left-click on the profile to activate a list of choices.

NOE. Nap-of-the-Earth As close as possible to the ground, flying relatively slowly.

Contour. Following the contours of the land, at moderate speed.

Cruise. Flying above terrain obstacles at full cruise speed.

Alt. Recommended altitude along the route.

Speed. Recommended speed of approach.

ToT. Time on Target. Estimated arrival time at this waypoint in minutes and seconds from the start of the mission.

Loiter. This is the time the flight is expected to hover above the waypoint before moving on. Loiter time in minutes and seconds can be set by left-clicking the "-" and "+" buttons. Each left-click changes the loiter time by 10 seconds. Use Shift to change the time by one-second increments and Ctrl to change the time by 60-second increments.

Action. This is, broadly speaking, what the flight is expected to do (or begin doing) at the waypoint.

Attack Target. The flight is to attack the designated target.

CAP. Combat Air Patrol. The flight is to engage any enemy aircraft in the area.

CAS. Close Air Support. The flight is to engage the enemy in support of a particular friendly ground unit.

SEAD. Suppress Enemy Air Defenses. The flight is to destroy air defense units.

Escort Unit/Flight. The flight is to escort a friendly unit or flight to the next waypoint.

Recon. The flight is to survey the area for enemy activity.

Lase Target. The flight is to paint a specific target with a targeting laser.

Deploy Troops. The flight is to insert troops into a battle area.

Pick up Troops. The flight is to evacuate troops from a battle area.

CAS Defensive. The flight is to engage a particular enemy unit threatening friendly forces.

Action Target. If the waypoint's action involves another unit (either supporting a friendly unit or engaging a specific enemy unit) this box shows you the unit involved. Left-click on a map icon of the appropriate type while the waypoint info box is open to make that unit the action target.

Power Button

This button will exit you from the Mission Planner and return you to the MMPC, from which you can fly or trash the current mission.

Fly Mission

Left-click on the flight helmet to fly the mission you've configured (with your newly loaded helicopter).

For information on the basics of flight, see **Flight Training**, Chapter 4.

Trash Mission

Left-click the wastebasket (or box) to abort the mission and return to the main screen for the overhead view of the Base.

Loading Terrain Maps

When you go into the game and fly your first mission of a session, the program may decompress the terrain maps appropriate to that mission and temporarily load them onto your hard disk. These maps depend on what area of the world you are in, and which missions you are flying. Successive missions are typically grouped together onto the same map so as to minimize the need to load new maps.

The default area loaded after you install the game is the National Training Center (used in the Training Campaign, Tutorial and Instant Action missions). If you fly a mission in a different area, you'll have to decompress a new map first. Whenever you are about to decompress a new terrain area, the game lets you know via a message plaque. Left-click OK to confirm the decompression, CANCEL to abort it. Terrain decompression can take a few minutes.

One way of minimizing decompression time is by using lower levels of terrain detail. To adjust the terrain detail level, open the **OPTIONS** menu and select WRAPPER. Then, lower the TERRAIN DETAIL LEVEL setting (options are LOW, NORMAL or HIGH). This also takes up less space on your hard drive.

ENDING A MISSION

If you successfully complete your mission objectives, you can end the mission by landing at your final waypoint, or by meeting one of the following conditions:

- You land at a Forward Air Refueling Point (FARP).
- You press Alt Q (quit mission).
- Your helicopter takes too much damage and explodes.
- You crash and are rescued or captured.
- You crash and die.

Landing at a FARP

Your last waypoint is always a FARP, but you can also land at other Forward Air Refueling Points anytime you find them. However, the number of times you can use these bases is limited — use them only if you haven't achieved the mission objectives. FARP supplies vary from location to location. If you land within 0.5 km of a FARP, you'll be presented with an option plaque:

CONTINUE	Continue flying the mission.
REARM AND REFUEL	Reload weapons and fuel, and resume the mission.
END MISSION	End the mission and go to the Debriefing area.

Debriefing Area

Once you've completed the mission (whether you succeed, fail, live, die or are captured), you'll go through a debriefing. The chalkboard points out your successes and failures in the mission and outlines what targets you destroyed. If the mission was successful, "Success" or "Success+" appears on the chalkboard. If it was a failure, "Fail" or "Fail–" appears instead. (The "+" means you had a highly successful mission, while "–" means you failed miserably.) The "Friendly Fire" category keeps track of how many friendly aircraft or ground vehicles/structures you damaged during the mission.

The acronyms on the chalkboard represent target types, and the numbers beside each indicate how many targets of that type were eliminated during the mission. Your score appears on the board, and accumulates during your pilot's career.

Important Note: *If you activate* INVULNERABLE *or* UNLIMITED AMMO *options during a mission, the current mission score will not be added to your total score.*

MISSION PLANNER (Extended Debrief) — Select the Mission Planning computer to view a detailed summary of the previous mission, including a status breakdown of every objective in the mission, all targets hit, an overall mission summary, and report on friendly casualties.

RE-FLY MISSION — Select the flight helmet to fly the previous mission again. A popup box will display and ask wish to change parameters. Select NO to fly with the same mission setup. Select YES to got the Mission Planner and adjust your setup.

ACCEPT — Select the curtain to exit the Debriefing Area. This returns you to the main mission screen for that mission type. It also saves your pilot's progress for that mission.

Saving Your Progress

The game has an automatic save feature that saves your progress each time you exit the Debriefing Area. It records scores and other mission stats for individual and campaign missions to the active pilot's stat sheet. (Instant Action Missions don't count.)

Whenever the active pilot is captured, killed or missing in action, he/she moves to "Inactive" status. Since this is an important action that ends the pilot's career, the game prompts you with a plaque to confirm this action. ***This happens regardless of whether automatic saving is active or not.*** If you confirm the action (by pressing [Y]), that pilot will no longer be available. To preserve the pilot's career, press [N] and re-fly the mission, or select the flight helmet on the table in the Debriefing area.

The ALLOW AUTOMATIC SAVING feature may be turned off in the **OPTIONS** menu by de-selecting the checkbox (it defaults to ON).

- Leave the ALLOW AUTOMATIC SAVING feature active if you don't want to be prompted to save after every mission. (If your pilot is killed/missing/captured, however, you will be prompted anyway.)
- Deactivate the automatic save feature if you want to be prompted to save after every mission, whether or not the mission was successful.

Crashing and Surviving

Your mission ends if you crash or get shot down. If you crash during a battle and survive, you'll see your helicopter crash.

Dying

When you are shot down or collide with something at high speed (either terrain or another aircraft), you'll see your helicopter crashing. Afterward, you'll find yourself in the Debriefing Room. You'll still get a debriefing and mission success/failure message (and might become a posthumous war hero).

GUARD SHACK

***Exit to Operating System* appears when this building is highlighted.**

- When you've completed your missions for the day, left-click on the Guard Shack to close *Longbow 2* and exit to *Windows 95*.

2
Cockpits

2. COCKPIT/SYSTEMS

As systems and weapons technology grow increasingly complex, flying a helicopter becomes a more difficult task. Pilots constantly have to scan 360° for threats while keeping both hands and feet on the controls at all times. And over the last few years, targeting, night vision and display systems have added new gauges, switches, displays and controls.

The size of the helicopter cockpit and its panels hasn't increased much to accommodate these new avionic systems. This has necessitated a more automated cockpit in which instrument readings are displayed onscreen and system adjustments are controlled by a computer.

Before your first takeoff, read the following descriptions of the aircrafts' instrumentation and systems. You can fly either the AH-64D Longbow Apache, the Longbow without Radar, the Kiowa Warrior or the Black Hawk in any mission.

Game vs. Reality

The heart of *Longbow 2* is its level of realism. Actual Apache pilots have logged hours testing the game, giving the development team valuable feedback on how the helicopter should handle and how the weapons should act. Dozens of notebooks full of manufacturing specs, physics, operating characteristics, aerodynamics and other resources were used as well, resulting in a nearly perfect simulation of helicopter flight.

Cockpit. The real Longbow Apache and Kiowa Warrior have separate cockpits for the pilot and co-pilot/gunner, as does the game. The CP/G functions (target sighting, prioritization and countermeasures) are automated in the single-player game, although you can also take direct control over them by adjusting game options. In a multi-player game, a different player can man each position. The Black Hawk has only one cockpit, but a door gunner station is modeled, which allows the player to take the part of a crew member manning one of the two pintle-mounted guns on either side of the Black Hawk's body.

Flight Dynamics. The dynamics in *Longbow 2* match the actual helicopter and have been aeronautically designed to correctly respond to control inputs and external physics. However, because piloting a helicopter — in reality and in this game — is not easy, you have the option of setting the level of realism (and thus difficulty) you prefer. (See **OPTIONS** menu in the *Install Guide* for details.)

Terrain. The maps used in this game were generated from actual U.S. Geological Survey maps and offer a variety of interesting combat environments. Perspective-correction technology also adds detail to the terrain and gives hills and canyons smooth edges.

Weapons. In the Longbow Apache, the TADS system automatically rotates the M230 Chain Gun (as the actual Longbow does) as you slew the camera. (You can view this in the exterior camera views.) Additionally, the weapons for all aircraft have realistic dynamics, graphical effects and operational ranges.

How to Use This Chapter

This chapter covers the cockpit and system features of all three flyable helicopters — the Longbow, Kiowa Warrior and Black Hawk. If a particular section applies to a specific helicopter, you'll see its name in bold letters, between horizontal lines like this.

Aircraft Overview, below, gives a description of the cockpits, IHADSS, MFDs, master modes and other cockpit items in the three aircraft of *Longbow 2*.

Integrated Helmet Display and Sight System, p. 2.12, introduces the IHADSS, the heart of the Longbow cockpit.

IHADSS Flight Symbology, p. 2.14, explains the intricacies of each IHADSS mode and defines what each element in the display means. Relevant key commands are given as well.

Multi-Function Displays, p. 2.24, describes the different pages you can bring up in the small MFDs mounted in the cockpit dash of each aircraft. Each page gives different information (such as targeting, navigation, damage, engine info, radar returns, weapons stores, etc.).

Co-Pilot/Gunner (Front Seat) Cockpit, p. 2.51, introduces the co-pilot/gunner cockpit and its functions in the Longbow and Kiowa, and gives detailed information about the Longbow's Optical Relay Tube display.

Targeting and Sight Systems, p. 2.46, discusses the details of the Longbow's Target Acquisition and Designation System (TADS), Longbow Fire-Control Radar (FCR), the Kiowa's Mast-Mounted Sight (MMS) and the night vision systems used by the aircraft.

Black Hawk Analog Cockpit, p. 2.54, covers those elements specific to the Black Hawk cockpit which use traditional analog controls and gauges rather than the more advanced digital electronics systems of the Longbow or Kiowa.

View Controls, p. 2.56, defines all the cockpit and external views you can use during the game.

AIRCRAFT OVERVIEW

Longbow Apache

The AH-64D cockpit has three primary information display systems. The first is the large, green display (IHADSS, or Integrated Helmet and Display Sight System) overlaid on your forward view. The second consists of two small screens (MFDs, or Multi-Function Displays) embedded in the cockpit. All the information you need to fly and engage enemies is displayed in these two systems. The last system, the Upfront display, gives damage and target information.

Kiowa Warrior

Because the Kiowa's primary function is to be a scout craft, rather than a gunship, it does not need the sophisticated radar targeting features of the AH-64D. It does have an MFD with pages mirroring most of the applicable features of the Longbow's system, and it also has a head-up display for rocket and missile targeting information. The Kiowa cockpit features a centrally located, moving map (shared by both positions) which displays a continually updating digital map of the area for use as a navigation aid.

Black Hawk

A no-frills transport aircraft, the Black Hawk has no cockpit-controlled weaponry or electronic targeting systems, and therefore it has no IHADDS or Upfront display. It does have an MFD which can display a limited number of navigational and communications-related pages, but a significantly greater percentage of its flight information is displayed by old-fashioned analog gauges.

In-Flight System Keys

Here are some common, non-control keystrokes you may need to use during flight:

Game Options

Alt O — Activate the OPTIONS menu

This is useful if you want to adjust play options, audio settings, controls or your key mapping. The option menu is completely described in the *Install Guide*.

Alt S — Toggle sound and speech effects on/off

Alt N — Display an in-flight navigation map

See **Mission Planner**, p. 1.11, for information on how to interpret and use the map.

Pausing / Ending the Mission

Alt P — Pause the game

Left-click OK or press Enter to resume play.

Alt Q — Quit the mission

If you have not achieved your objectives, you fail the mission, but have the option to re-fly it.

Alt X — Exit to *Windows 95*

Keep in mind that the current mission will not be saved if you exit from in-flight.

Note: *In multi-player games, only slave players can exit the game without ending it. If the host player exits or quits, the game ends for all players.*

Speeding up Travel

Tab — Activate time compression

You can cycle through 2X, 4X and 8X. Use this when you want to get to where you're going quickly. If time compression is active, the current rate appears in the top right corner of the IHADSS display.

Shift Tab — Restore normal time (1X)

Note: *Time compression does not apply to multi-player games.*

Radio

Ctrl S — Replay last radio message with mission-specific information

Overview: Integrated Helmet and Display Sight System (IHADSS)

Longbow

Of the three helicopters in *Longbow 2*, only the AH-64D itself has an IHADSS system. (The Kiowa has a simpler head-up display called the Pilot's Display Unit — see p. 2.48 for details.)

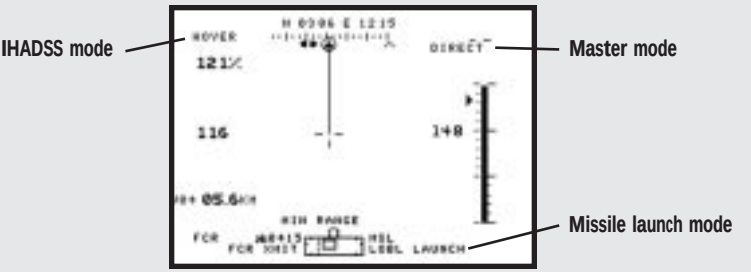
The IHADSS is a system that superimposes data onto a small eye display mounted on the wearer's helmet. In the game, it appears as a bright green assortment of digital readings and electronic bar gauges in the middle of your viewscreen at all times.

The IHADSS has four modes of operation — *Hover, Bob-Up, Transition* and *Cruise*. Each IHADSS mode best applies to a certain situation, such as when you're navigating or hovering. (See **IHADSS Flight Symbology,** p. 2.14, for mode symbology.)

End — Cycle through IHADSS modes

What is a Mode?

The term *mode* is used several times in this manual, and has different meanings in different contexts. However, it always refers to *modes of operation.* Take care not to confuse the different mode types. The following items are detailed later in this chapter.



IHADSS modes The 4 IHADSS modes overlay different information on the IHADSS display in your viewscreen. See p. 2.14 for more information.

End Cycle through IHADSS modes

Missile launch modes You can fire Hellfire missiles using LOBL (lock-on-before-launch) or LOAL (lock-on-after-launch) missile launch mode. See p. 5.18 for a full explanation.

Ins Toggle between LOBL/LOAL missile launch modes

Radar modes The Longbow radar has both an air radar mode (which scans 360° for air targets) and a ground radar mode (which scans a 90° arc in front of the helicopter for ground targets). See p. 2.29 for more information.

U Toggle between air/ground radar modes

Master modes Each master mode automatically switches the above items to pre-determined settings. When you select a master mode, you are effectively selecting the IHADSS mode, MFD pages and missile launch mode with a single keystroke.

Choose a certain master mode based on your current situation (whether you're navigating, firing at ground targets, or searching for air targets). See p. 2.9 for more information.

M Cycle through master modes

Overview: Multi-Function Displays (MFDs)

Longbow, Black Hawk, Kiowa

The green-and-black cathode-ray tube (CRT) displays found in the cockpits of all three helicopters are Multi-Function Displays (MFDs). Each displays a "page" of information you access by pressing a key. You can access nine different pages in the Longbow Apache. All available pages can be displayed in any MFD.

The Longbow has two MFD screens in the pilot's position, and two more in the CP/G cockpit. The Kiowa has one MFD for the pilot's seat, and another for the CP/G. The Black Hawk has only one MFD.

MFD pages provide a myriad of data, including information on targets, weapons, navigational points, radar returns and system status.

[<,] Cycle through left MFDs (also controls Kiowa CP/G MFD, not applicable in Black Hawk)

[>.] Cycle through right MFDs (also controls Kiowa pilot MFD)

MFD Types

The page reference tells you where to go to find extensive details. (Details on ranges for various displays apply when you play with certain realism options active.) For a list of which helicopters display which MFDs, see the facing page.

Tactical Situation Display (p. 2.24)	(TSD) Displays battlefield information, including waypoints, targets and enemy lines.
Radar (p. 2.29)	Shows ground targets in a 90° arc in front of the helicopter (ground radar mode) or air targets in a 360° radius (air radar mode) at 2, 5, 10, 25 or 50 kilometer ranges. With REALISTIC FOR RANGES on, the ranges are .5, 1, 2, 4 or 8 kilometers.
Target Acquisition and Designation Sight (p. 2.32)	(TADS) Displays various TADS camera images and an image of the currently selected target.
Weapons (p. 2.33)	Displays the weapon load for the helicopter, as well as the current sight system and active weapon.
Aircraft Survivability	(ASE) Displays ground threat and missile icons in a 360° view around your aircraft. It has ranges of 2, 5, 10, 25 and 50 kilometers.
System (p. 2.38)	Displays the helicopter's main systems and gives the status of system components and the amount of fuel remaining.
Engine (p. 2.38)	Gives information on engine torque, RPM, temperature, and fuel remaining.
Flight (p. 2.40)	Displays important IHADSS symbology, including altitude, airspeed, torque and waypoint information.
Communications (p. 2.40)	(Comms) Displays the current designations and callsigns of all units currently in communications.
Vertical Situation Display (p. 2.41)	(VSD) Found only on the Kiowa, this versatile page combines many of the functions of the Longbow's Flight and Weapons pages.
Mast-Mounted Sight (p. 2.43)	(MMS) The Kiowa's equivalent to the Longbow's TADS MFD.

MFDs Sorted by Aircraft

MFD	*Longbow Apache*	*Black Hawk*	*Kiowa*
TSD	♦	♦	♦
System	♦	♦	♦
Comms	♦	♦	♦
ASE	♦		♦
Radar	♦		
TADS	♦		
Weapons	♦		
Engine	♦		
Flight	♦		
VSD			♦
MMS			♦

Overview: Targeting Systems

What is TADS?

Longbow

TADS stands for Target Acquisition and Designation Sight, the basic sighting and imaging system of the AH-64D. Essentially, it is a targeting system that uses lasers, low-light optics and an infrared camera to identify and track targets. The TADS system lets you lock onto a single target that is in front of you, and also displays an image of your target inside the TADS MFD.

You can control the TADS camera that is mounted in your helicopter's nose, slewing it left or right (as if you were actually moving your head). When you look left, the camera and the chin mounted gun turn to the left as well. TADS can look 110° left or right, 30° up and 60° down.

The camera is only *part* of the TADS system; the entire system is quite complex and uses camera images and a computerized targeting system.

See **Target Acquisition and Designation Sight, p. 2.32,** for more details on this system and how to use the TADS camera.

See **Target Acquisition Modes, p. 5.10,** for information on targeting threats using TADS.

What is FCR?

Longbow

FCR stands for Fire-Control Radar, a second type of target acquisition system found only in the Longbow. When you bob-up from behind a hill, the bulbous Longbow radar dome on top of the helicopter automatically scans either a 90° pie-shaped arc (for ground threats) or a 360° circle (for air threats) and "memorizes" targets. The beauty of the FCR system is that you can store multiple targets and then fire off missiles in quick succession. After launch, the missiles lock onto individual targets identified by the FCR. (TADS, by contrast, can only store/track one target at a time.)

While tracking ground targets with FCR target acquisition active, the safest way to update radar information is to mask yourself in a valley or behind a hill or other natural terrain, maintain a steady hover and slowly raise the helicopter. Your radar automatically updates whenever the top of your mast has a line of sight (LOS) to the target.

See **Mast-Mounted Longbow Radar (FCR),** p. 2.46, for more details on this system.

See **Target Acquisition Modes,** p. 5.10, for information on targeting threats using FCR.

What is MMS?

Kiowa

MMS stands for Mast-Mounted Sight. This is the primary sighting and imaging system of the Kiowa Warrior. In broad terms, it is the functional equivalent of the Longbow's TADS. The MMS camera is located high up on the Kiowa's rotor mast (hence the name) giving the Kiowa the Longbow's ability to take sightings from beneath treelines or ridge lines. The MMS enjoys an arc of 190° to either the right or left, giving it a functional radius of 360°, and a vertical range of 30° up or down.

MASTER MODES

Longbow, Kiowa

You can switch your various modes, displays and sensors individually, or you can use master mode keys to switch your systems to predetermined settings. Each master mode activates a specific combination of MFDs, sensor system, missile launch mode and IHADSS (Longbow).

In the Kiowa, the master mode key changes the MFDs and missile launch modes. Master modes are useful because you can easily activate all the items you need for a certain situation with a single command.

Four master modes exist — **Navigation** (NAV), **Direct** (LOBL), **Indirect** (LOAL) and **Air-to-Air** (ATA). You can cycle through them with a common keystroke (M), or select modes with a specific keystroke (Shift 1, Shift 2, Shift 3 or Shift 4). In the Longbow, the name of the current master mode appears in the upper left corner of the IHADSS display.

M		Cycle through master modes (Navigation, Direct, Indirect and Air-to-Air).

The following keys switch to a master mode immediately, and are useful when programming a joystick with multiple buttons.

Shift 1	**Navigation (NAV)**	Use when navigating to a waypoint.
Shift 2	**Direct (LOBL)**	Use when firing missiles or rockets at ground targets while in Lock-On-Before-Launch (LOBL) missile launch mode.
Shift 3	**Indirect (LOAL)**	Use when firing missiles or rockets at ground targets while in Lock-On-After-Launch (LOAL) missile launch mode.
Shift 4	**Air-to-Air (ATA)**	Use when firing guns or Stinger missiles at air targets.

Master Mode Settings

The chart below shows settings for each of the master modes. The leftmost column shows the master mode name; the other columns show individual mode settings. Each system's details are described in the remainder of this chapter.

Longbow

Master Mode	IHADSS Mode	Left MFD Page	Right MFD Page	Target Acquisition System	Missile Launch Mode
NAV	Cruise	ASE	TSD	TADS	LOAL
DIRECT	Transition	TADS	TSD	TADS	LOBL
INDIRECT	Bob-Up	WPN	TSD	FCR	LOAL
ATA	Cruise	Radar (air radar mode)	TSD	FCR	LOBL

Kiowa

Master Mode	Left MFD Page	Right MFD Page
NAV	ASE	TSD
DIRECT	MMS	VSD
INDIRECT	MMS	VSD
ATA	MMS	VSD

Upfront Display

Longbow

This is the digital display in the top right section of your cockpit that gives information, such as system failures and a mission clock. (See p. 5.21 for additional targeting information using the UPFRONT display.)

[U] Toggle Upfront display (between engine/rotor readings and target information)

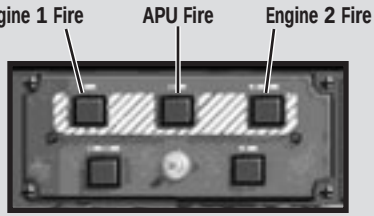
Black Hawk Indicator Lights

The red lights on the Black Hawk's instrument panel give useful information during flight. You have one light (the Master Caution) over the virtual horizon gauge, and a strip of three lights in the center of the pilot's cockpit. Glowing lights are "on" and indicate the following conditions.

Master Caution		Your chopper has taken damage (Check the System MFD page.)
HDG (Autopilot 1) and NAV (Autopilot 2)	[A]	Autopilot is engaged (Move cyclic/collective to disengage.)
ALT (Hover Hold)	[H]	Autopilot hovering is engaged (Press again to disengage.)

Longbow Fire Warning Lights

The left side of the Longbow cockpit has three lights, that indicate engine fires.



Engine 1 Fire	Your port (left) engine is on fire.
APU Fire	Your auxiliary power unit (APU) is on fire.
Engine 2 Fire	Your starboard (right) engine is on fire.

In case of a fire, use your fire extinguisher (available only once per mission), or shut down the engine that is on fire.

Ctrl F	Activate fire extinguisher (once per mission)
Ctrl [, Ctrl]	Shut down left/right engine

Physical Backup Gauges

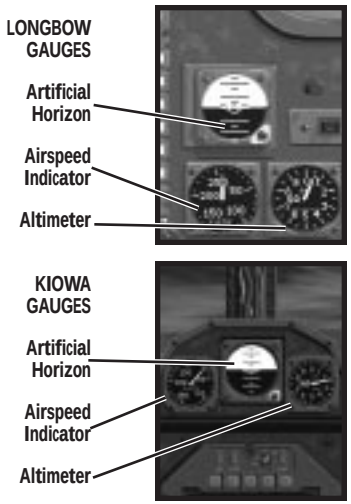
Longbow, Kiowa

In the Longbow and Kiowa, the incorporation of electronic systems and helmet displays have reduced the number of physical gauges and switches to under 200. Most of the flight information has been moved into the IHADSS and MFD displays.

The indicators and readings you'll need most appear in electronic form. However, several physical, secondary gauges are also in the cockpit in case of cockpit electronics failure.

The following physical backup gauges appear in the Longbow and Kiowa cockpits:

Airspeed indicator. Dial gauge showing how fast the helicopter is traveling in knots. (A knot is a nautical measure of speed, approximately equal to 6,076 feet/hour. This distance is equal to a nautical mile.) The indicator scale ranges from 0 to 250 knots.



Altimeter. Dial gauge giving the helicopter's altitude in feet above sea level (*not* height above ground level). Each clock-wise revolution of the needle indicates +1000 feet of altitude, and each counter-clockwise revolution indicates -1000 feet. The counter in the center of the dial increments or decrements one digit for each revolution.

Artificial Horizon. Dial gauge using a horizontal line to display the helicopter's attitude relative to the horizon. This line remains parallel to the horizon regardless of the craft's pitch or roll angles.

The Black Hawk makes use of many more physical gauges — see p. 2.54.

Using PNVS / ANVIS (Night Vision Systems)

If you're having trouble flying at night or in bad weather, try activating the night-vision system. The Longbow Apache uses Martin Marietta's PNVS (Pilot Night Vision System) while the Kiowa and Black Hawk use the ANVIS/HUD system from AEL. These systems make flying easier by using the night vision camera to provide a passive light amplification image of the terrain. Use night vision if you're having trouble seeing the ground. (PNVS and ANVIS are not targeting systems — they are used solely for flying the aircraft.)

P Toggle the night vision system on/off

INTEGRATED HELMET AND DISPLAY SIGHTING SYSTEM (IHADSS)

The IHADSS is used only in the Longbow Apache, not in the Kiowa or Black Hawk.

The Longbow Apache's Integrated Helmet and Display Sighting System (IHADSS) allows the pilot and co-pilot/gunner to monitor navigational and targeting information on a small eyepiece display mounted on their helmets. (In the game, the "eyepiece" is what you see in the viewscreen.) The IHADSS combines readings from several subsystems into a single optical screen.

Using the IHADSS

This integrated helmet system is automatically on whenever the helicopter is in operation. However, you'll need to switch IHADSS modes during flight.

The IHADSS has four modes of operation — **Hover**, **Bob-Up**, **Transition** and **Cruise**. The name of the current IHADSS mode appears in the upper left corner of the display. The information presented changes slightly between the different modes, and also varies with different weapons.

End Cycle through IHADSS modes

The following keys switch to an IHADSS mode immediately, and are useful if you're programming a joystick with multiple buttons.

Shift 5	Activate **Hover** IHADSS mode (use when hovering)
Shift 6	Activate **Bob-Up** IHADSS mode (use when popping out/firing from a masked position)
Shift 7	Activate **Transition** IHADSS mode (use when taking off, landing, or going from a hover to forward flight)
Shift 8	Activate **Cruise** IHADSS mode (use during forward flight)

Reading IHADSS information. Everything on this screen is vital, and understanding your overall environment is critical to your survival. However, don't be overwhelmed by the numbers and lines sitting in the middle of your screen — the next section (**IHADSS Flight Symbology**) explains it all.

Adjusting the IHADSS. You can adjust the brightness of the display. The brightest setting is neon-green, the medium setting is dark-green, and the darkest setting is black. Change the brightness if you're having trouble distinguishing IHADSS items in the forward view.

Alt I	Brighten IHADSS display (changes to bright green)
Ctrl I	Dim IHADSS display (changes to dark green, then black)

***Note:** IHADSS information is also superimposed onto the F2 (left cockpit), F3 (right cockpit) and F4 (virtual cockpit) views.*

IHADSS Helmet System

Both Longbow crew members wear the Honeywell-developed IHADSS, which consists of a helmet and display eyepiece, a graphical adjustment panel, two electronic units, and two sensor units. The sensor units are connected to the helmet by two cables that transmit information about the helmet's current position and the line of sight for each crew member.

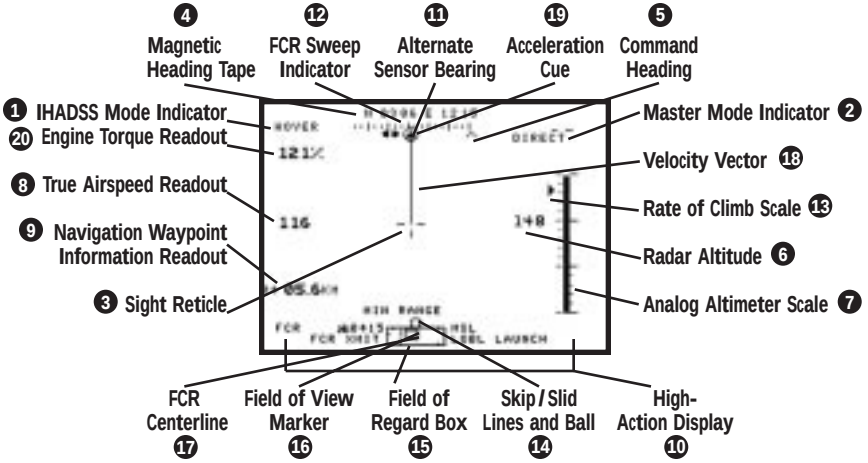
The helmet display unit (HDU), or eyepiece, is attached to the right side of the helmet and can be flipped vertically when not in use. A cathode-ray Optical Relay Tube inside the eyepiece projects symbology and images onto a monocle sight. The display background is a grayscale (10 shades of gray), composite image gathered by infrared camera systems. Targeting information from the TADS is then superimposed on this image, along with navigational information, such as compass heading, attitude lines, velocity vector, vertical speed and altimeter reading.

The IHADSS gives vital flight information to both occupants, and allows the co-pilot/gunner to aim the guns by moving the helmet. It also allows the pilot to process multiple pieces of information in a single glance, instead of constantly dividing attention between the dashboard and external environment. This is a major asset during combat, especially when ground fire and enemy aircraft pose imminent hazards.

IHADSS FLIGHT SYMBOLOGY

Longbow

The Integrated Helmet and Display Sighting System projects assorted navigational and targeting information onto a display. It also displays symbols generated by the Target Acquisition and Designation Sight system and uses an infrared nighttime display (the Pilot Night Vision System). Information from the flight instruments, navigational system and weapons system is overlaid on this video display and appears in a small reticule mounted on the helmet.



1 IHADSS Mode Indicator. The name of the current IHADSS mode appears in the upper left corner as HOVER, BOB-UP, TRANSITION or CRUISE. Elements that appear in each mode are discussed in this section.

End Cycle through IHADSS modes (see p. 2.14 for individual keys).

2 Master Mode Indicator. The name of the active master mode appears in the upper right corner of the display as NAV, DIRECT, INDIRECT or ATA.

M Cycle through master modes (see p. 2.9 for more details).

Hover IHADSS Mode

Shift 5 Activate Hover IHADSS mode (use when hovering).

3 Sight Reticule. Line of sight cross hairs in the center of the display mark the center of your straight-ahead view. (A similar reticule with dashed lines appears when a target has been selected. Take care not to confuse the two.) When firing guided weapons, line up the solid reticule with the target. The appropriate weapon indicator will turn solid, indicating that you have a valid weapon lock and can let loose with your missiles or rockets (see **Weapon-Specific Items**, p. 2.22).

❹ **Magnetic Heading Tape.** Scrolling tick marks on the top of the display show the four compass directions — N, S, W and E. Other indicators (the command heading and the FCR radar heading) are overlaid on the tape.

←, → Use the cyclic to change headings — the tape scrolls accordingly. (At speeds below 60 knots, use the rudder pedals — [or].)

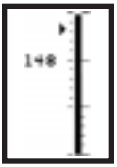
❺ **Command Heading.** This small open carat on the magnetic heading tape (4) shows the compass heading of the next programmed waypoint. Center this chevron in the middle of the heading tape when you're flying to the next navigational point.

←, → If the chevron appears to be stuck on the left or right side of the heading tape, turn to move it toward the center of the heading tape. (Again, you can also use [or] at slow speeds.)

❻ **Radar Altitude.** This digital readout shows the helicopter's altitude in feet above ground level, as long as altitude remains below 1420 feet. It changes in 1-foot increments. When flying above 1420 feet, rely on your barometric altimeter (25 – see **Cruise IHADSS Mode**, p. 2.21).

+, − Adjust collective to change altitude (at low speed, or while hovering)

↑, ↓ Move the cyclic up/down to change altitude (while cruising)



❼ **Analog Altimeter Scale.** An analog version of the radar altitude indicator, this bar gives the helicopter's altitude in feet above ground level (which is not necessarily equal to feet above sea level). As altitude increases, the thin bar grows taller; as the helicopter descends, it shortens. Once you climb above 200 feet, this altimeter disappears.

The five small tick marks that extend to the right (at the bottom of the scale) indicate 10-foot increments up to 50 feet. The other tick marks that extend to the left apply to the rate of climb scale (13 – see p. 2.17).

If autopilot is active, another number appears above the altitude reading. It gives the current autopilot altitude setting and changes if you alter it using Ctrl ↑, ↓.

❽ **True Airspeed Readout.** This digital readout indicates the current forward speed of the helicopter. It doesn't take wind or sideways/backward motion into account. This gives the true airspeed (from 0 to 250 knots) in a numerical display. However, it doesn't reflect accurate speeds when you're traveling in a direction other than straight ahead.

↑ Push cyclic forward to increase airspeed (but not too far, or you'll descend)

↓ Ease up on cyclic to reduce airspeed (or pull up sharply)

If autopilot is active, another number appears above the airspeed reading. It gives the current autopilot airspeed setting and changes if you alter it using Ctrl ←, →.

❾ **Navigation Waypoint Information Readout.** This readout gives the currently selected waypoint number (such as W06) and the remaining distance in kilometers. A time to arrival also appears (in Cruise and Transition IHADSS modes).

When you specify a new waypoint, navigation information changes. Your current waypoint appears as a flashing circle in the **TSD MFD** (see p. 2.24), and as a number in the IHADSS display. The heading to the next waypoint appears as an open carat that scrolls along the bottom of the heading tape.

[W] Select next waypoint. [Shift][W] Select previous waypoint.

[Alt][N] Toggle in-flight Navigation map (to view waypoints and see mission information)

See **Mission Planner**, p. 1.11, for map details.

❿ **High-Action Display**. The text fields surrounding the large box at the bottom of the IHADSS are collectively called the high-action display. It gives weapon and sensor information. The high-action display also appears in Head-Down view (see **Optical Relay Tube Unit**, p. 2.53), along with current airspeed and altitude readings.

Weapon Type. FFAR rocket (RKT), Multi-Purpose Sub-Munition rocket (MPSM), Hellfire (MSL) or Stinger missile (ATA)

[Bksp] Cycle through weapon types (except guns)

Missile Launch Mode. Lock-on-before-launch (LOBL) or lock-on-after-launch (LOAL) missile launch mode (see **Engaging Targets with Hellfires**, p. 5.18).

[Ins] Switch between LOAL and LOBL missile launch modes

Weapon Inhibit. Weapon launch parameters appear here (see p. 5.20).

Sight Status. This field tells whether the laser or FCR is transmitting. The text field changes, depending on the active targeting system, and whether or not you have realistic options selected. If FCR is active and you're playing with realistic fcr options, FCR XMIT appears. (If you're playing with simple options, FCR ACQ appears instead.)

When you're playing with the REALISTIC TADS option, if the TADS system is active and the laser is on, TRGT appears. Whenever the laser transmits, an asterisk flashes next to this text. (If you're playing with simple options, TADS ACQ appears instead.)

[Home] Switch between TADS and FCR.

Range. Range-to-target in kilometers (such as 1.2). The letter "A" means that range has been automatically calculated by the computer. The range field switches formats, using the most accurate method available.

A##.#	TADS triangulation method of calculating range (inaccurate)
R##.#	FCR range (more accurate, but only updates once per scan). See **Realistic FCR Operation Commands**, p. 2.31.
*####	Laser range (most accurate). See **Laser Operation**, p. 5.22.
XXX.X	No range information is currently available.

Advanced Hover IHADSS Mode Elements

⓫ **Alternate Sensor Bearing.** The alternate sensor bearing is a small, solid chevron that displays along the bottom of the heading tape (4). This symbol indicates the direction of the TADS sensor relative to the line of travel of the helicopter.

The field of view marker (16) inside the field of regard box (15) moves to reflect this position, which can move +30° to -60° vertically and 220° horizontally.

If you're using TADS target acquisition, this indicator shows the bearing of the currently selected target. As long as you keep TADS active, this chevron "sticks" to the heading tape and scrolls left or right as the tape moves. If FCR is the active target acquisition system, it remains locked on the currently designated target, because the FCR can have multiple targets.

[8], [2], [4], [6] Numpad	Slew TADS camera (view current line of sight in TADS MFD).
[F4]	Activate Virtual Cockpit view (you can slew in this view as well).
[Alt] + Joystick	If you're in the [F4] view, you can also use the joystick to slew the camera.

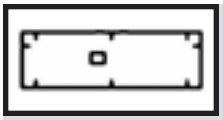
Note: *When you're using FCR target acquisition, you can't move the TADS camera. (Press [Home] to switch between TADS and FCR.)*

⓬ **FCR Sweep Indicator.** This solid, double arrow scans from left to right and shows the current scanning direction of the mast-mounted radar. The radar gathers information on targets identified during "bob-ups" and transmits this information to the FCR target acquisition system.

⓭ **Rate of Climb Scale.** The triangular indicator on this tick-mark scale describes how fast the helicopter is climbing or descending. It slides vertically along the left side of the scale, moving up when the rate of change is fast and down when it's slow. The ticks on the tape correspond to 100-foot-per-minute changes in altitude.

⓮ **Skid/Slip Lubber Lines and Ball.** The pair of lines (lubber lines) indicates the center position for the skid/slip ball indicator, much like the lines on a builder's level. Skidding, also known as slipping, occurs when the helicopter is traveling in a forward direction, but slides sideways because of forward momentum gained from the previous heading.

The small circle that moves along the lubber lines is called the skid or slip ball. Like the air bubble in a level, this ball resides between the skid lubber lines when the helicopter is traveling in a true, forward path. When the helicopter slips left or right, this circle slides accordingly.

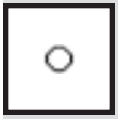


⓯ **Field of Regard Box.** The large rectangle centered along the bottom section of the IHADSS display is the field-of-regard box. It represents the 220° x 90° field of view of the TADS camera. When you pan the TADS camera left or right, the small rectangle inside this box (the field of view marker) moves accordingly. (See Alternate Sensor Bearing (11) for camera slew commands.)

⓰ **Field of View Marker.** This small rectangle inside the field of regard box (15) indicates where your TADS camera is pointed in relation to the current flight path of the helicopter. The rectangle describes the TADS camera's current field of view. (This box simulates what the CP/G can see in reality without moving the TADS sensor package.)

⓱ **FCR Centerline.** This centerline appears in the field of regard box (15) and shows the current bearing of the target locked by the Fire-Control Radar. A small horizontal line across this centerline shows the elevation of the radar in relation to the field of regard.

⓲ **Velocity Vector.** This line between the center of the sight reticule and a small dot is an overhead, graphical representation of the helicopter's lateral velocity. It takes both speed and severity of motion (such as turning sharply) into account. The faster the helicopter is traveling, the longer the line. It points in the direction the helicopter is traveling.



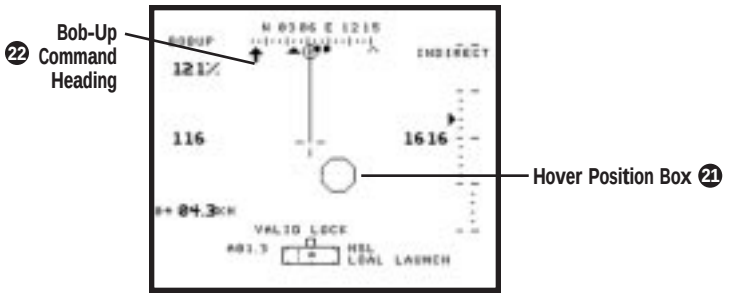
⓳ **Acceleration Cue.** This mobile circle is similar to the velocity vector, only it provides a graphical position that takes into account the helicopter's current acceleration. The higher the rate of acceleration, the further the circle moves away from the center of the viewscreen.

⓴ **Engine Torque Readout.** This digital indicator shows how much torque is being output by the engines, and displays the highest torque of the two engines. A torque value of 98% or greater causes this box to gain a solid border, alerting the pilot that the torque limit has been exceeded.

You can over torque for a while but it adds excessive wear and tear to the helicopter.

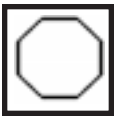
If torque is too high, reduce collective.

Bob-Up IHADSS Mode



Shift 6 Activate Bob-Up IHADSS mode (use when you're hidden and need to bob-up to fire)

This IHADSS mode includes all items that appear in Hover IHADSS mode, but also incorporates the hover position box and a second command heading.



21 Hover Position Box. This octagonal box originates at the center of the viewscreen and gives an "overhead" view of approximately an 8' x 8' area of ground. (The entire IHADSS display, by comparison, represents a 44' x 44' area.) The sight circle in the middle of the IHADSS display represents the helicopter's position. As the helicopter drifts, the octagonal box moves around onscreen and indicates how far you've strayed from the original hover position.

Try to keep the octagon centered over the sight reticule. The easiest way to do this is to move your flight control device *toward* the octagon. If the box is to the left and up, for example, press the joystick left and up. With a little practice, you'll be able to anticipate the box's movements and keep your helo in the middle of it.

If this proves too difficult, use the hover hold feature. (You must be flying at a speed below 15 knots to activate this autopilot function.) You can also re-center the octagonal box on your sight reticule.

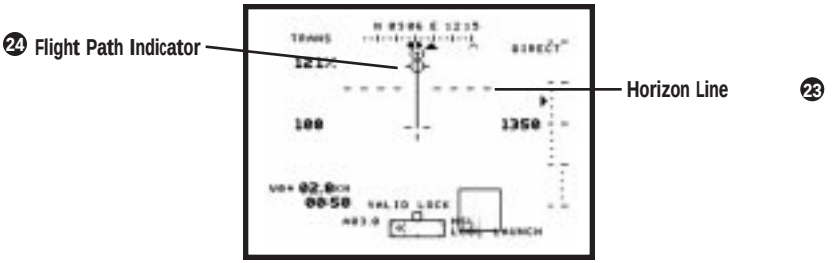
H Toggle hover hold (maintain current altitude and hover)

Shift 6 Press the Bob-Up IHADSS mode key again if you drift too far and want to re-center the box over the sight reticule

Advanced Bob-Up IHADSS Mode Element

22 Bob-up Command Heading. During bob-up maneuvers, a second chevron appears on the magnetic heading tape (4). This represents the helicopter's heading as it was when the Bob-Up IHADSS mode was engaged, and it remains on that heading until the pilot switches the IHADSS mode.

Transition IHADSS Mode



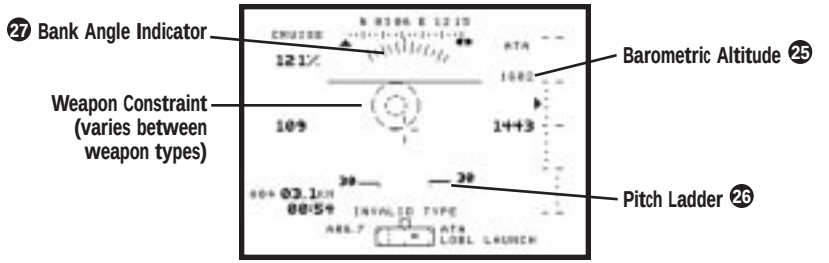
Shift 7 Activate Transition IHADSS mode (use when landing or moving from a hover into forward flight)

The Transition IHADSS mode displays all the information in Hover IHADSS mode, along with two additional items — the horizon line and flight path indicator. The estimated time to arrival for the current waypoint also appears to the left of the High Action Display (10).

23 Horizon Line. Whenever the helicopter is flying level, this dashed line is flat and centered on the sight reticule in the center of the viewscreen. When you perform a pitch maneuver, the line moves up or down to reflect the angle of climb/descent. Similarly, the line "tilts" as you bank the helicopter left or right.

24 Flight Path Indicator. The flight-path indicator (FPI) is a small circle with tick marks extending up and to the left and right. It indicates the helicopter's current direction of travel and moves up, down, left and right as you maneuver.

Cruise IHADSS Mode



Shift 8 Activate Cruise IHADSS mode (use when cruising in forward flight)

In Cruise IHADSS mode, the IHADSS displays all the information found in Transition IHADSS mode, except that the horizon line (23) disappears. Instead, there are three additional readouts — barometric altitude, pitch ladder and bank angle indicator. The estimated time to arrival for the current waypoint also appears to the left of the High Action Display (10).

25 **Barometric Altitude.** Since the radar altitude indicator (6) only reads up to 1420 feet, another device is necessary at higher altitudes. The barometric altitude readout is a digital display that gives altitudes from 0 to 30,000 feet above sea level. To figure altitude, it compares the current air pressure to a pressure calibrated at sea level. (Air pressure decreases as altitude increases.)

26 **Pitch Ladder.** The pitch ladder is a series of horizontal lines that scroll vertically in the center of your view. It describes both vertical movement and bank/roll angles. When the craft dives, the lines scroll upward; during ascents, they scroll downward. The pitch ladder is also capable of rolling 360° (the lines tilt to reflect the bank angle).

Pitch ladder lines above the horizon are solid; those below the horizon are dashed. (The small tips on the ends of the lines point toward the horizon.)

27 **Bank Angle Indicator.** This indicator is a curved scale that usually displays 30° to the left and right of center in 5° increments. The same command heading mark (lubber line) that marks the heading on the heading tape (4) also marks the bank angle of the helicopter.

Weapon-Specific Items

Longbow

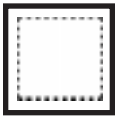
See **Kiowa Pilot Display Unit**, p. 2.48, for information on weapon constraints in the Kiowa.

Whenever you're using certain weapons, additional items are added to the IHADSS display. It doesn't matter which IHADSS mode is currently active — these elements are dependent on the current weapon type. A short name for the active weapon type appears next to the High-Action Display box (10) — MSL for Hellfire missiles, RKT for rockets, MPSM for multi-purpose submunition rockets, and ATA for Stinger missiles.

Bksp	Select active weapon (cycle through Hellfires, rockets and Stingers)
Ctrl M	Toggle weapons between ARM (active) and SAFE (inactive)
Spacebar	Fire active weapon
Enter	Fire cannon

When the weapon system is active, targeting information is gathered and displayed by either the TADS or FCR. Much of this information appears in the **TADS MFD** as well (see p. 2.32).

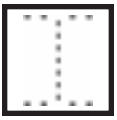
Target Reticule. These small, dotted cross hairs mark the location of the current target.



Hellfire Missile Constraint. Specific to Hellfire missiles, this box indicates the direction in which you need to move to align the helicopter with the current target. You must maneuver the helicopter to line up the box with the target reticule.

The computer applies certain constraints to the Hellfire locking mechanism. When you align the dashed cross hairs with the target, the missile has a valid lock, and the constraint border switches from a dashed line to a solid one. The constraint box moves in the direction of the target. For example, when the box drifts to the right, it indicates that the pilot needs to look/steer right to bring the target into view and acquire a lock.

Basically, what you need to do is maneuver so that the target reticule (shown above) is inside the weapon constraint symbol. When you do so, you'll see VALID LOCK on the screen. This indicates that you have a lock and can fire your weapon.



Rocket Steering Cursor. Specific to 2.75-inch Folding Fin Aerial Rockets, this I-beam shows what direction the helicopter needs to move to meet the constraints for firing FFARs. The rocket constraint only displays if this rocket type is active, and its operation is similar to that of the Hellfire missile constraint box. The steering cursor's purpose is to help the crew members look/steer toward the target and bring it into view for a lock. It won't allow a lock if safety or performance is inhibited, or if the Master Arm indicator is set to SAFE (press Ctrl M to arm weapons). When the helicopter is correctly aligned, the I-beam switches from dashed to solid, indicating that you have a valid lock and can fire a rocket.

Your FFAR launcher pivots up and down when you're locked onto a target. This allow the pilot to hit a target anywhere vertically on the 'I' beam reticule.

ATA Missile Constraint Circles. When the air-to-air (ATA) missile system is active, two concentric circles appear on the display and indicate where the missile seeker head is looking. The circles are solid if all performance and safety constraints have been met, and are dashed if they have not.

Missile Timer. When you launch a Hellfire missile, a missile timer appears in the High-Action Display (10) on the IHADSS, counting down in seconds. When it reaches zero, the missile strikes the target.

MULTI-FUNCTION DISPLAYS (MFDS)

All three helicopters use MFDs — each description lists the appropriate helicopters that use that display.

One of the defining features of the current generation of combat helicopter is the addition of MFD displays in the cockpit. In the Longbow, two CRT screens exist, and both can independently display nine different pages of information (see **MFD Types**, p. 2.6).

Tactical Situation Display (TSD) (p. 2.24)
Radar (RAD) (p. 2.29)
Target Acquisition Designation Sight (TADS) (p. 2.32)
Weapons (WPN) (p. 2.33)
Communications (Comms) (p. 2.40)
Aircraft Survivability Equipment (ASE) (p. 2.35)
System (SYS) (p. 2.38)
Engine (ENG) (p. 2.38)
Flight MFD (p. 2.40)

Kiowa Only

Mast-Mounted Sight (MMS) (p. 2.43)
Vertical System Display (VSD) (p. 2.41)

In the actual helicopters, the pages are accessed via buttons around the perimeter of the screen. In the game, you use keystrokes.

[<,]	Cycle through the left MFDs (in the order listed above). (In the Kiowa, this cycles the CP/G MFD.)
[Shift][<,]	Cycle through the left MFDs in reverse order.
[>.]	Cycle through the right MFDs (also the Kiowa Pilot MFD).
[Shift][>.]	Cycle through the right MFDs in reverse order.
[M]	Switch master mode (changes both MFD displays).

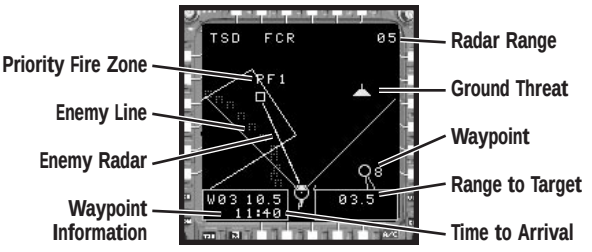
MFDs are explained in order of usefulness, not order of appearance in the game.

Tactical Situation Display (TSD) MFD

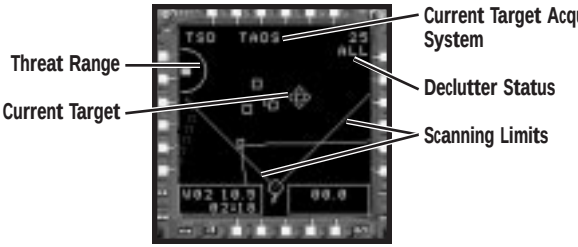
Longbow, Kiowa, Black Hawk

The Tactical Situation Display, or TSD, is one of the most vital MFD pages during combat situations. It provides various battlefield information, including waypoints, enemy positions, air threats, anti-aircraft threats, priority fire zones, enemy lines and more.

EXAMPLE 1



EXAMPLE 2



Although the Black Hawk does not have a targeting system, it can still receive TSD information through its communications system from other helicopters and the ABCCC. Since the Black Hawk has no cockpit-controlled weaponry, the targeting functions of the TSD are fairly useless, although the targeting readouts on the MFD are still useful for recognizing and avoiding threats.

On the Longbow, the heart of the TSD is the cone-shaped radar display that reflects the FCR scanning area. This display receives its target information from either the TADS or FCR target acquisition system.

How It Works

The TSD display emanates from the helicopter's nose (the bottom of the "V") and extends 45° to either side for a 90° sweep. (The Radar MFD appears similarly in ground radar mode — see p. 2.29.) The *scanning limit* of the radar scan appears as two solid, angled lines. Any enemy craft or vehicles in this cone can be picked up by the radar and display as TSD icons.

Targets picked up by the radar appear as small icons on the radar (see next page). Priority fire zones are notated as PF0, PF1, PF2, etc., and show outlines around areas you've designated as important target areas. Labeling is slightly different in multi-player games. See the *Multi-Player Guide* for details.

Radar Range. Range of the applicable radar.

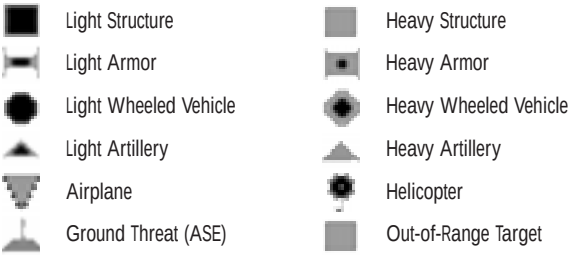
Pg Dn — Cycle through radar ranges (2, 5, 10, 25 or 50 kilometers). The currently selected range appears in the upper right corner of the display.

Alternatively, left-click (🖱) on the current range in the MFD to increase range, right-click to decrease it.

If the Realistic FCR Range Option is selected (see *Option Menus* in the **Install Guide**) it is possible to set different ranges for the TSD and Radar. Set TSD range with Pg Dn and increase/decrease the Radar range with Z and X.

Targets. Once identified threats (air or ground) move within your radar range, they switch from small boxes to graphical symbols on the TSD MFD. You can left-click directly on a threat symbol to lock onto it. SAM and AAA threats also display on the Aircraft Survivability Equipment (ASE) page.

Each category of threat has its own symbol. When REALISTIC FOR SYMBOLOGY is active, the symbols change. See p. 2.30 for realistic FCR symbols.



Range to Target. The range in kilometers to the locked target appears in the bottom right corner of the display.

Waypoints. Mission waypoints (if in range) appear as circles with numbers; the currently selected waypoint flashes. Lines showing your flight route appear in the display. The box in the lower left corner gives IHADSS information – the selected waypoint (such as W03) and the distance in kilometers. **Time to Arrival** also appears.

Enemy Lines. Linear arrangements of brackets indicate enemy lines. When you cross these boundaries, your CP/G informs you that you've flown into enemy territory.

Current Target/Air Threats. Locked targets have a bright diamond outline.

Priority Fire Zone. Green boxes are PFZs, or primary target areas that you create by right-clicking and dragging the mouse (see next page). Your targeting system prioritizes targets in these zones, allowing you to fire multiple Hellfires. Each missile tracks a different target when you're in FCR target acquisition mode.

Enemy Radar. When an enemy threat activates its radar system, a solid line emanates from its icon, indicating that you are being tracked by its radar. If the line starts flashing, it means the target has gained a lock on you and has fired a missile.

Threat Range. Large arcs or circles represent effective ranges of SAM sites.

Adjusting TSD Items

In the TSD display, you can adjust scale, designate targets, and declutter symbology.

Range to Target. This is the distance to the current target in kilometers and appears in a box in the bottom right corner.

Pg Dn	Cycle through TSD ranges
	Alternatively, left-click (🖱) on the current range in the MFD to increase TSD range, right-click to decrease it

Declutter Status. You can "de-clutter" the TSD by displaying only navigation information (NAV), target information (TGT) or both (ALL), in that order.

D	Declutter symbology (cycle)

Current Target. The current target has a diamond around it. With TADS target acquisition active, you can only cycle through targets in your line of sight. With FCR active, all detected targets appear, whether you can physically see them or not.

T / Shift T	Cycle through enemy targets (forward / backward)
Y / Shift Y	As above, but cycles only through friendly or neutral targets
🖱	Lock onto the target under the mouse cursor in the TSD MFD

Note: *If the* REALISTIC TARGETING *option is active, then* T *cycles through all targets. See the* **OPTIONS** *menu section of the* Install Guide *for details.*

TSD with Realistic FCR

With REALISTIC FCR OPERAITON active, the display changes slightly. The 90-degree arc is replaced by a pie-shaped arc (in ground mode) or circle (in air mode) that outlines the new scan area. You control the angle and size of this scan using Numpad keys. See **Realistic FCR Operation Commands**, p. 2.31.

Priority Fire Zones (PFZs)

It is useful to select certain zones as target priorities. These zones let you fire up to 16 Hellfire missiles (your entire bank) one after the other. Each missile tracks a single target, allowing you to simultaneously engage 16 targets.

By creating a PFZ, you instruct your targeting system to acquire targets in this area first. You can trade PFZ information with your wingman, or assign your wingman to different areas (see **Wingman Commands**, p. 5.24).

🖱	Right-click-and-drag on the TSD MFD display to create a Priority Fire Zone. This draws a green box around the designated zone and gives it a label (such as PF0). When you create a PFZ, the active targeting system loses its current locks and acquires up to 16 targets within this area instead. Missiles launched into PFZs attack the locked target first. If a missile's target is destroyed before it reaches its target, the missile shifts to another target within the zone. If all targets have a missile tracking them, then missiles begin doubling up on targets. (See **Priority Fire Zones,** p. 5.11, for detailed information.)
Shift🖱	Add targets to your PFZ target list by pressing Shift and left-clicking on the target you want to add. This is useful when new threats move inside your PFZ. You can use this key to tell Hellfire missiles which targets to strike first — it moves them to the top of the target list.
Q / Shift Q	Select next/previous PFZ Alternatively, left-click (🖱) on a PFZ label to select it.
🖱, then 🖱	Delete a PFZ by left-click-and-holding on the label, then right-clicking.
Shift D	Delete currently selected PFZ
Ctrl D	Delete all PFZs

PFZs and Hellfire Missiles

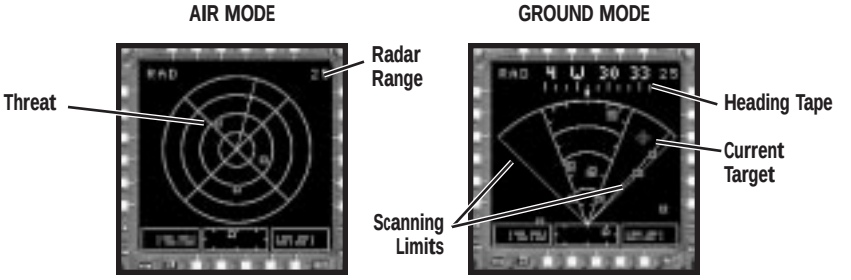
PFZs are useful if you're using radio-frequency (RF) Hellfire missiles in LOAL missile launch mode. You can bob-up, acquire targets with FCR target acquisition active, and then descend to safety. The FCR system "memorizes" the objects it detects – so you don't have to have them in view when you fire. Then, you can make a PFZ and assign it to your wingman, and make a second one for yourself.

Once you launch an RF Hellfire, it heads toward the currently selected PFZ and selects targets based on the FCR's target list. If the primary target gets destroyed before the missile arrives, it simply moves on to the next target in the list. All you have to do is rapidly fire off as many missiles as you have targets. Time to impact appears in the High-Action Display.)

See **Engaging Targets with Hellfires,** p. 5.18, for specific details.

Radar MFD

Longbow



The Radar MFD reflects raw returns from the helicopter's radar and displays target information from either the TADS or FCR targeting system (whichever is active). It operates in two modes — air or ground — and has different ranges. Use air radar mode to find air targets, and ground radar mode to sweep for ground targets.

Pg Up — Toggle between air-to-air radar mode (360° sweep) or air-to-ground radar mode (90° sweep)

Pg Dn — Cycle through radar ranges (2, 5, 10, 25 and 50km)

If the REALISTIC FCR RANGE option is selected, the distances cycle through .5, 1, 2, 4 and 8km.

Alternatively, left-click (🖱) on the current range in the MFD to increase radar range, right-click (🖱) to decrease it.

Radar Range. The current range of the radar appears in the upper right corner of the page.

Threat. Targets picked up on radar appear as small boxes.

Current Target. The currently selected target has a bright diamond around it.

Air Radar Mode

In *air radar mode*, the radar conducts 360° sweeps and displays air threats as small boxes relative to the helicopter's position in the middle of the display.

Ground Radar Mode

In *ground radar mode*, the radar conducts periodic 90° sweeps in front of the helicopter. In addition to the air-mode information, ground radar mode displays two more items:

Scanning Limits. The angled lines to either side of the display indicate the scanning limits of the radar when it's in ground radar mode.

Heading Tape. A heading tape identical to the one on the IHADSS display (4, p. 2.14) scrolls across the top of the display.

Realistic FCR Options

You have more control over the radar if REALISTIC FOR OPERATION is active in the OPTIONS MENU under *Gameplay/Realism/Custom*. This controls how the FCR operates and changes the appearance of the TSD MFD (as well as the Radar MFD).

Numpad [Enter]	Turn radar on/off (or, in TADS mode, turns laser on and off)
REALISTIC FCR SYMBOLS	This option replaces normal symbology on the Radar and TSD MFDs with new symbols that indicate whether targets are visible/not visible and moving/stationary.
REALISTIC FCR RANGE	The second option switches the available FCR ranges from 2.5/5/10/25/50km to .5/1/2/4/8km. With this option active, you press [Z] and [X] (or Numpad [+] and [–]) to cycle forward and backward through the ranges (instead of [Pg Dn]).
REALISTIC FCR OPERATION	The third option gives you manual control of the FCR scan by letting you change the size and direction of the radar scan. Since your radar can reveal your presence to some enemies, adjusting your FCR scan can help you avoid detection.

Realistic FCR Symbols

New symbols show on the Radar/TSD MFDs if REALISTIC FCR SYMBOLS is active.

Tracked Vehicle	No LOS*	
	LOS, stationary	
	LOS, moving	
Wheeled Vehicle	No LOS*	
	LOS, stationary	
	LOS, moving	
Air Defense Unit	No LOS*	
	LOS, stationary	
	LOS, moving	
Unknown Target	No LOS*	
	LOS, stationary	
	LOS, moving	
Helicopter	No LOS*	
	LOS, stationary	
	LOS, moving	
Aircraft	LOS, moving	

** Line of Sight*

Realistic FCR Operation Commands

If FCR is the active target acquisition system, and REALISTIC FCR OPERATION is selected, you can control your Fire-Control Radar scan as follows.

Numpad 4, 6 — Control direction of Fire-Control Radar scan (left or right)

Numpad 8, 2 — Increase, decrease arc size of FCR scan (up to 90 degrees)

Reducing the arc of the scan reduces your visibility on enemy radar detection systems and gives you quicker updates.

When the radar is in air-to-air mode, the scan (at maximum width) appears circular on the Radar and TSD MFDs. In ground mode, the scan is pie-shaped.

RADAR MFD

Z, X or — Increase, decrease radar range (to .5, 1, 2, 4 or 8km)

Numpad +, − — These ranges apply only if REALISTIC FCR RANGE is active. If not, the range is 2, 5, 10, 25 or 50km, and you must use the normal key (Pg Dn) to cycle through ranges.

Numpad 3 — Toggles single or continuous FCR scan

Single means the radar only makes one sweep each time you turn it on. Continuous means that the radar keeps scanning the entire arc back and forth until you turn the radar off.

Numpad 9 — Zoom Radar MFD image in around your current target. (ZOOM flashes in the lower left corner of the MFD.)

Downloading Targets to the TSD

You can download targets from other sources onto your TSD if you've activated the realistic FCR options. Nearby ABCCCs (Airborne Battlefield Command and Control Centers) receive targets from other friendly ground and air units in the area. These targets are added to the ABCCC's list, giving you access to a comprehensive picture of the battlefield.

When you activate ABCCC targeting, targets from the nearest C&C center are downloaded to your target list.

Ctrl ~ — Download unseen targets to the Longbow target list

Note: *If you give your wingman the* Ctrl 4 Pop-up and Scan Area *command, he'll feed targets directly into your target list. You don't need to use* Ctrl ~ *to get his targets.*

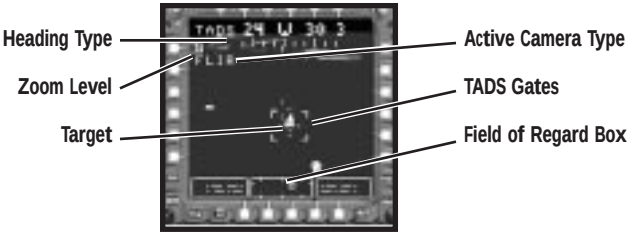
Target Acquisition and Designation Sight (TADS) MFD

Longbow

The TADS MFD displays camera images gathered by the TADS sensor package.

From the co-pilot/gunner cockpit (front seat), you can display the TADS MFD as a full-screen view. (See **Co-Pilot/Gunner (Front Seat) Cockpit**, p. 2.51, for details.)

Numpad [.] — Toggle full-screen, Head-Down Display of TADS MFD (or Radar MFD, if FCR is active). Press again for normal cockpit view. You must be in the CP/G (front-seat) cockpit to use this view.



Target. This is a camera image of the currently selected target.

Heading Tape. A replica of the IHADSS heading tape (4, p. 2.14) lines the top of the MFD, but it doesn't show the centerline.

Zoom Level. Current TADS camera zoom (WIDE, MEDIUM, NARROW – see next page).

TADS Gates. Large brackets around an object in the MFD mean that you have this object targeted. (You target a different object by centering it in the TADS MFD and pressing [L] to lock it. If no other targets appear, pan the camera to find one.)

Field of Regard Box. The large box at the bottom of the TADS MFD represents the entire field of view of the TADS camera. The small box inside this rectangle shows the TADS camera's current position relative to its entire field-of-view. (This item also appears at the bottom of the IHADSS – 15, p. 2.14.)

Active Camera Type. A camera image of the target comes from one of three TADS sight sensor systems. An acronym for the active system displays in the upper left — DVO (Direct View Optics), DTV (Daylight TV) or FLIR (Forward-Looking InfraRed).

Numpad [1] — Cycle between TADS camera modes (FLIR, DVO and DTV)

Or, left-click (🖱) on the camera name to cycle modes. FLIR works best in foggy or dark conditions; DVO and DTO work best in daytime.

FLIR. This monochrome image has been improved, and you now have "white-hot" and "black-hot" options. White-hot displays white objects on a black background, while black-hot displays black objects against a white background.

Numpad [7]	Toggle between white-hot/black-hot FLIR imagery

DTV. The Daytime TV camera gives you a good visual of a target at the Narrow zoom level setting. Use this to identify targets at fairly long range.

DVO. The Direct-Video Optic camera is good for long-distance reconnaissance.

Panning / Zooming

[Z], [X] or [+], [–] on Numpad	Switch TADS camera (FLIR, DTV and DVO) zoom level to Wide, Medium or Narrow (medium only applies to FLIR) Or, left-click (🖱) the current zoom level to change it.
[8], [2], [4], [6] Numpad	Pan the active camera in any direction. (This corresponds with the head tracking system in actual Longbows.) You can also hold down [Alt] and move your joystick to pan the camera. As a third option, left-click-and-hold (🖱) in the TADS MFD and drag the mouse in any direction to pan.

TADS and Realistic FCR

With REALISTIC FCR OPERATION active, target symbology displays on top of the FLIR, DVO or DTV image when TADS is full-screen (CP/G cockpit only – see p. 2.51). The symbology changes if REALISTIC FCR SYMBOLOGY is selected (see p. 2.30). The currently locked target has cross hairs on top of it. They move when you switch targets.

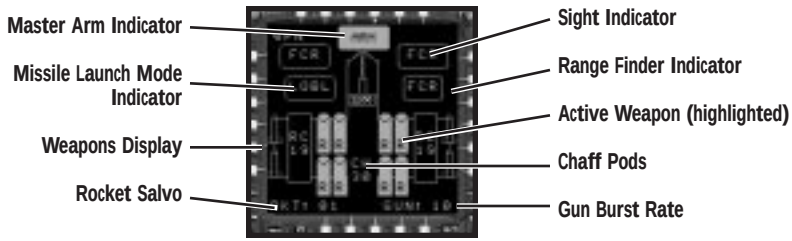
Realistic TADS Operation

If you select REALISTIC TADS OPERATION in the OPTIONS menu (*Gameplay/ Realism/ Custom*), you must manually activate the laser. See **Laser Operation**, p. 5.22.

Weapons MFD

Longbow

The Weapons MFD identifies what ordnance the helicopter is carrying and what sensor system is active. The large schematic represents the helicopter and its four wing pylons (hardpoints). The indicator text boxes denote the active target acquisition system and weapon tracking system, and whether weapons are armed or not.



Bksp Cycle through weapon types (highlighted box is active weapon)

Spacebar Fire active weapon

Enter Fire cannon

Home Switch target acquisition system (TADS or FCR)

Master Arm Indicator. This safety measure toggles weapons between ARM and SAFE states. Keep it on SAFE until you're ready for battle.

Ctrl M Switch between ARM and SAFE

Weapons Display. Shows how many weapons/countermeasures remain of each type. This display uses an aircraft symbol with boxes that represent weapon hardpoints.

The gun counter in the middle of the symbol (a box and number) tell how many cannon rounds remain. You can adjust the number of rounds that fire per trigger pull (referred to as a gun burst). Press G to cycle between 10, 20, 50 or 100 rounds.

Active Weapon. The active weapon system appears as a reversed (bright green) image. Numbers inside the rocket box indicate how many rockets are left. In the case of Hellfires and Stingers, each missile is represented by a single icon.

If you loaded radar-guided Hellfires, the missile hardpoint box reads R. If you loaded laser-guided Hellfires, LR appears instead.

If you loaded HE FFAR rockets, the rocket hardpoint box reads RC. If you loaded multiple-projectile submunition rockets, MP appears instead. (You must gain a lock before firing MPSM rockets. Select rockets as your active weapon, then wait for the I-beam cursor to turn solid. See **Folding Fin Aerial Rockets**, p. 5.17.)

Sight Indicator. Shows which targeting system is acquiring and designating targets. TADS indicates that you're selecting targets from the TADS target list. This list consists of targets the CP/G has chosen for you within range and in a 220° arc in front of you.

FCR indicates that you're getting targets from the FCR target list. This list consists of targets within range and in a 90° arc in front of you.

Home Switch between TADS and FCR target acquisition systems

Range Finder Indicator. Indicates that Hellfires are using the Longbow's laser-designator to range targets instead of the Fire-Control Radar (only active if you're firing laser-guided Hellfires).

If you're using TADS target acquisition, this box reads LRF. If you're using FCR target acquisition, the text box changes to FCR.

Missile Launch Mode Indicator. Shows which missile launch mode is active — LOAL (lock-on-after-launch) or LOBL (lock-on-before-launch). See **Engaging Targets with Hellfires**, p. 5.18, for details.

Chaff Pods. The number to the right of the chaff indicator (C:) shows how many chaff cartridges remain.

C Release chaff

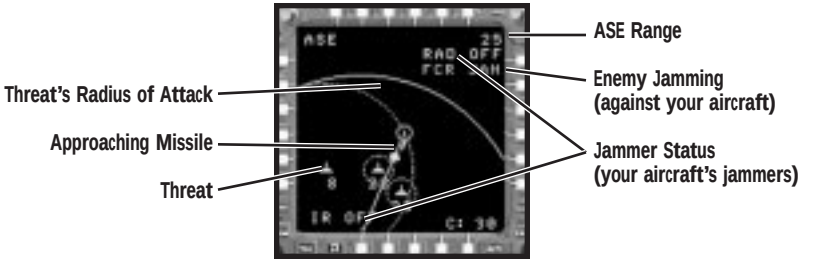
Rocket Salvo. The number to the right of RKT tells how many rockets are launched when you issue a fire command.

S Cycle through rocket salvo sizes (1, 2, 4, 8, 12 or 24)

Aircraft Survivability Equipment (ASE) MFD

Longbow, Kiowa

The ASE display gathers information from the Radar Warning Receiver (RWR) and Radio Frequency Interferometer (RFI) and creates a 360° view of missiles, SAMs and AAA threats around your helicopter, which is centered in the view. Whenever a threat is within range and emits radar, this MFD displays its position. The ASE page also tells you when you have jamming activated.



Threats. Threats located and identified by the RWR and RFI show up as symbols. Numbers by the symbols identify the threat type — for example, a ground threat symbol with an 8 indicates a Russian SA-8 SAM site. A solid diamond denotes an **Approaching Missile**. The symbols are defined under **Tactical Situation Display (TSD) MFD**, p. 2.24.

Symbol	Threat Type		
6	SA-6 SAM	11	SA-11 SAM
8	SA-8 SAM	13	SA-13 SAM
9	SA-9 SAM	15	SA-15 SAM
10	SA-10 SAM	23	ZSU-23 AAA Gun
		26	2S6 (SA-19) SAM

Radius of Attack. The radius of attack for ground threats, or the area within which you're vulnerable to their fire. Circles in the MFD indicate the attack limits of a particular enemy ground gun or SAM site. Stay outside these arcs to avoid their fire.

The arcs change appearance according to the enemy's actions:

Dotted arc	Threat is searching with radar.
Solid arc	Threat is tracking with radar.
Flashing arc	Threat has launched a guided missile.
Line to you	Threat is searching, tracking or launching missiles specifically at you.

Jammers. The ASE system indicates whether IR and radar jammers are active or not. When they're in use, text appears (IR JAM or RAD JAM), and a flashing lightning bolt appears on top of your helicopter icon in the center of the ASE. (The IR jammer is often called the "disco light.") Both jammers activate automatically, but you can also control them manually.

[I] Toggle infrared (IR) jamming (attempts to deter IR missiles)

[J] Toggle radar jamming (attempts to confuse enemy radar systems)

When your Fire-Control Radar is being jammed by enemy systems, FCR JAM appears in the upper right corner of the MFD.

Realistic Jammers

Jammer information displays in the ASE page. The RWR defaults to unrealistic, meaning that it jams threats in 360° radius. To give the jammer realistic scanning ability (in a 45° arc to either side of the current flight path), open the **OPTIONS** menu and select CUSTOM from the REALISM section of the **GAMEPLAY** menu. Then, select the REALISTIC JAMMER checkbox.

Radar Range. This is the range at which the RWR is scanning for threats emitting radar (the RWR displays its information in the ASE MFD). You must adjust the ASE range separately from the Radar MFD range.

[Delete] Cycle through ASE ranges (2, 5, 10, 25 and 50 kilometers)

Alternatively, left-click (🖱) on the current range in the MFD to cycle through scan ranges.

ASE Autopage

You can automatically instruct the ASE page to appear whenever you're engaged by a SAM or AAA gun by pressing Shift A. (This key toggles the function on/off — it's on by default.) The ASE Autopage function is useful during combat and saves you from paging through MFDs while you're taking fire. When the battle is over, the ASE doesn't disappear — you must manually deactivate it.

What is Aircraft Survivability Equipment?

The Longbow and Kiowa have a collection of Aircraft Survivability Equipment that helps the pilot identify and repel anti-aircraft threats. These include the following items:

Radar Warning Receiver (AN/APR-39A). Sounds a tone and voice warning when you're picked up by an enemy's radar.

Laser Warning Receiver (AN/AVR-2). Sounds a tone and voice warning when you're being tracked by a laser.

Radio Frequency Interferometer (RFI). Detects the strength and wavelength of incoming radar waves.

Chaff Dispenser (AN/ALQ-136). Releases strips of reflective material designed to confuse radar-guided missiles by distorting radar.

Radar Jammer (also AN/ALQ-136). Broadcasts radar "noise" that clutters opposing radar screens.

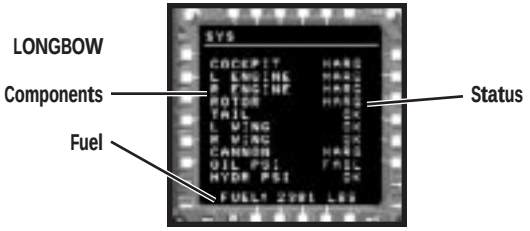
Infrared Jammer (AN/ALQ-144 IRCM). Reflects laser beams to blind incoming IR missiles. Also called "disco light."

IR Suppressor (Black Hole). Cools exhaust during hovers and forward flight to reduce heat signature.

Information from ASE components appears on the Aircraft Survivability Equipment (ASE) MFD in the Longbow and Kiowa.

System MFD

Longbow, Kiowa, Black Hawk



Components. The helicopter's components are listed inside the MFD. (The Kiowa and Black Hawk System MFDs differ slightly, but the status names are the same.)

The System MFD shows how badly your helicopter has been damaged by displaying the status of each important system as follows:

OK System is operational.

MARG System has marginal damage.

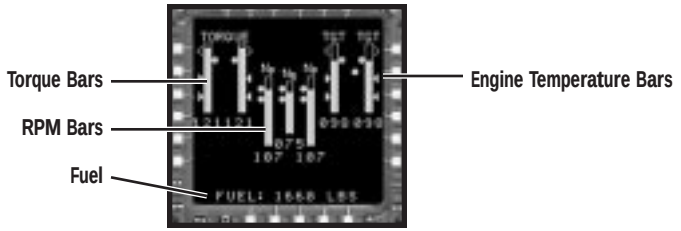
INOP/FAIL System is inoperative.

Note: *A message appears on the UPFRONT display if the FCR no longer functions. See* **Damage**, p. 5.4*, for other damage information that appears on the UPFRONT display.*

Fuel. The amount of fuel remaining appears at the bottom of the MFD. Fuel burns at approximately 1 lb. every 5 seconds.

Engine MFD

Longbow



The Engine MFD monitors the torque level and temperature for both of the Longbow's engines. Information appears both in bar format and digital format (below each bar). Indicators on the bar denote ranges and maximum levels.

The torque bars increase in height when you add collective, and decrease when you reduce collective. Try to keep the torque level at or below the solid circle marker at the top of the bar display — it marks the desirable torque setting.

[+=] Add collective (increases torque)

[-_] Decrease collective (decreases torque)

Interpreting the Symbols

Symbols beside the bars describe minimum, maximum and safe operational ranges.

 Max level of operation.

 Ideal level of operation.

 Maximum level of operation with rotor RPM at approximately 90% (top arrow).
Maximum level of operation with rotor RPM at approximately 50% (lower arrow).

 Normal operating range (revolutions per minute).

You can turn individual engines on and off using the keyboard. If one of your engines catches fire, it's a good idea to shut it down.

[Ctrl][[] Toggle left engine on/off

[Ctrl][ ]] Toggle right engine on/off

Additional Information

Torque. Twin bars marked TORQUE indicate the percentage level of torque on the rotor. The bar rises in height as the collective is increased (greater pitch angles increase the level of torque) and shrinks as collective is decreased. (The bottom of the bar represents 0%, the top represents 120%.)

Normally, torque averages 80% to 100%. Ideally, the bar should extend up to the solid dot (recommended setting). You can take 120% torque for short bursts, but prolonged high torque can damage your engine. The reading for the engine producing the most torque appears in the upper left corner of the IHADSS (20, p. 2.18).

N_p / N_R Two gauges marked N_P display revolutions per minute readings for the left and right turbine engines. The N_R gauge displays revolutions per minute for the rotor shaft.

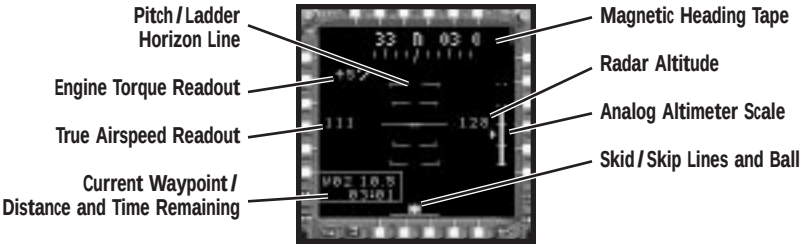
TGT. The TGT gauges indicate the temperature of the left and right engines.

Fuel. The amount of fuel remaining appears at the bottom of the MFD. Fuel burns at approximately 1 lb. every 5 seconds.

Flight MFD

Longbow

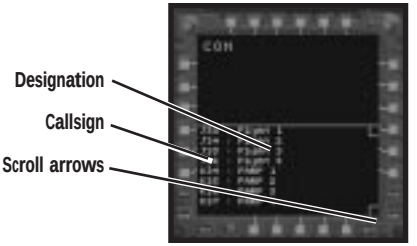
This MFD page displays important IHADSS information — the pitch ladder, slip ball, current waypoint and distance to it, altitude, airspeed, heading and torque. (Refer to **Cruise IHADSS Mode**, p. 2.21, to learn how to interpret this display.)



Communications (Comms) MFD

Longbow, Kiowa, Black Hawk

This MFD displays the designation and callsign of every unit in communications.



Left-click the arrows in the scroll bar to scroll through the list of friendly, airborne units

[/] Scroll down COMM MFD

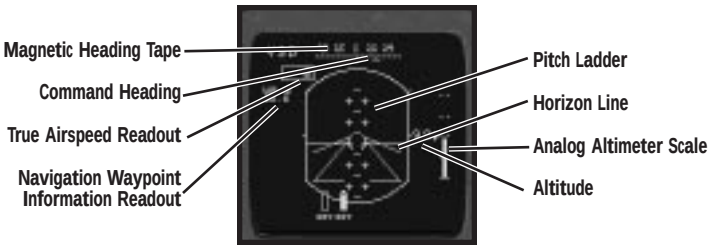
[Shift] [/] Scroll up COMM MFD

Vertical System Display (VSD) MFD

Kiowa

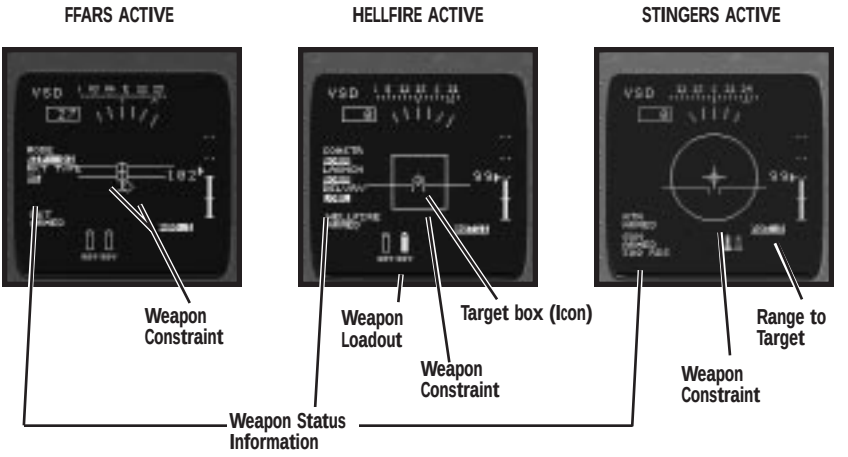
This versatile MFD, unique to the Kiowa Warrior, is basically three MFDs in one, combining many of the functions of the Longbow's Flight and Weapons MFD pages. Which one displays depends on a) whether or not the Master Arm function is on or off, and b) what weapon is active. See **IHADSS Flight Symbology,** p. 2.14, for details on items in this display.

Master Arm OFF (see p. 2.34) The VSD functions as a flight reference, showing the artificial horizon, speed, distance to waypoint, altitude and similar aids to navigation.



Master Arm ON, weapons active The VSD becomes a weapons sight, displaying available targets, distance to target and other relevant information for the weapon type selected. The diamond icon on the VSD displays where the Mast-Mounted Sight is currently pointing, while the circle icon is your pitch indicator. When both icons are lined up with the target, the target is firmly in your sights.

See **Kiowa Weapon Constraints**, p. 2.49, for specifics on acquiring locks with weapons.



Range to Target. The range in kilometers to the locked target appears in the bottom right corner of the display.

Waypoints. The box in the lower left corner gives navigation information — the selected waypoint (such as W03) and the distance in kilometers. **Time to Arrival** also appears.

Target Box. Once you have a target in your field of view, a small diamond appears on the VSD. If the target moves out of view, the diamond moves in that direction. To gain a firing lock on that target, maneuver the helicopter so that the diamond moves under the VSD weapon constraint. Your weapon constraint will turn solid (described in the next paragraph).

Weapon Constraint. The VSD displays a weapon constraint. Its shape differs, based on whether you have the machine gun, Hellfires, Stingers or rockets active. This same constraint displays on the Pilot's Display Unit — see **Kiowa Weapon Constraints,** p. 2.49, for details.

Weapon Loadout. These small icons show what missiles you're carrying (Hellfires or ATA Stingers). The solid icon indicates the active weapon.

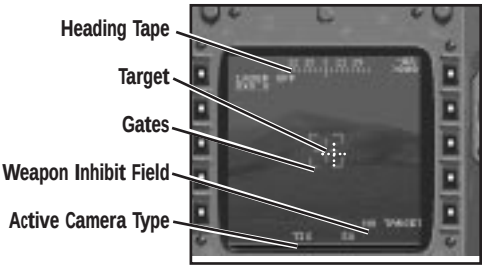
Bksp	Switch active weapon

Weapon Status Information. These text fields display the arming status (ARMED or SAFE), launch mode and weapon inhibit information for the active weapon.

Mast-Mounted Sight (MMS) MFD

Kiowa

This MFD performs basically the same function for the Kiowa as the TADS MFD performs for the Longbow. Although the organization of the information is a bit different, the functionality of the MFD is the same.



Target. This is a camera image of the currently selected target.

Heading Tape. The helicopter's heading tape lines the top of the MFD. The center of this tape indicates the current compass direction in which you are facing.

Gates. Large brackets around an object in the MMS MFD mean that you have this object targeted. (You target a different object by centering it in the MFD and pressing [L] to lock it. If no other targets appear, maneuver around until you find one.)

Weapon Inhibit Field. In the Longbow, messages describing whether or not you have a weapon lock, or the reason why you don't, appears in the IHADSS. In the Kiowa, this message appears in the MMS MFD in the lower right corner. See **Weapon Inhibit Field**, p. 5.20, for a list of messages.

Active Camera Type. The cameras used in the Kiowa are different than those used in the Longbow. A camera image of the target comes from one of two Kiowa sight sensor systems. An acronym for the active system displays in the bottom center — TIS (Thermal Imaging System) or TVS (Television System).

Numpad [1]	Toggle between MMS camera modes (TIS or TVS)
🖱	Or, left-click on the camera name to toggle modes

To zoom the camera in and out:

[Z], [X] or	Switch MMS camera zoom level
[+], [−]	(TIS zooms to 6X or 25X; TVS to 5X or 17X).
(Numpad)	Or, left-click (🖱) the current zoom level to change it.

MMS Bearing. Unlike the TADS, the Kiowa MMS has no field of regard. Instead, numeric angles appear in the top right corner of the MFD and represents the current slew angles of the MMS sight. The top line indicates vertical slew angle (-30 degrees to +30 degrees) and the second line indicates the horizontal slew angle (-170 degrees to +170 degrees).

Range. Range to the currently selected target.

IN-FLIGHT NAVIGATION SYSTEM

See Mobile Mission Planning Cell, p. 1.10, for more details on this map.

The game has an in-flight navigation system that looks and feels very similar to the Mission Planning screen. The map's main purpose is to display the current, real-time position of your helicopter, as well as all helicopters in other flights.

Most of the other data and display options are identical to the Mission Planner — the major difference is that you can't change tasking assignments, weapon load-outs, or crew positions. You can't rehearse the mission or view a terrain profile.

Another difference between the Mission Planner and this map is that you can't adjust any waypoints that were set before you took off. You can, however, add new waypoints to your own flight path (but not the flight paths for other helicopters). Adding waypoints is most useful when you run across unforeseen situations — by adding a new waypoint, you can sometimes avoid trouble or answer a request for assistance.

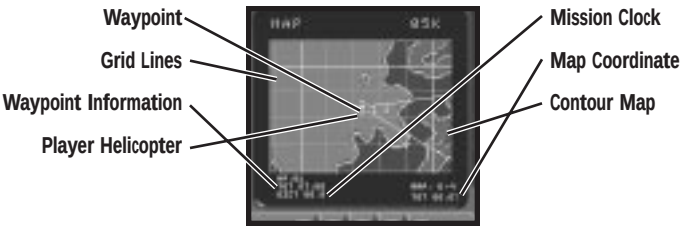
After you've added a new waypoint, you're free to move it or delete it.

- To add a waypoint, left-click on the small green box between two sequential waypoints. All subsequent waypoints will be renumbered accordingly.
- To move a waypoint, left-click-and-drag it to any point on the map.
- To delete a waypoint, right-click on it to open the Waypoint Information Window, and left-click on the Delete box. All subsequent waypoints will be renumbered accordingly.

KIOWA DIGITAL MOVING MAP

Kiowa

The Kiowa comes with a scrolling digital map display that displays known information about the area. The map appears in the center dashboard display, and is shared by both cockpits. This display has no sighting function — it is purely a navigational aid. Note that the digital map is based on archived geographic information, not on the imaging systems of the Kiowa itself.



Contour Map. The contour map (see p. 1.12) appears behind this MFD, and scrolls as you fly over the terrain. The lighter contour, the higher the terrain. Low, flat areas appear as a darker shade of green. The top of the map is always north.

To toggle the background map, left-click MAP OFF (it then changes to MAP ON).

Grid Lines/Map Coordinates. The map is segmented into 1-kilometer squares by thin, green grid lines, as well as into 5-kilometer squares marked by bold, green grid lines. Where the heavy 5km grid lines intersect, map coordinates appear.

The coordinates of the map quadrant you're currently flying over appears in the lower right corner as a letter, followed by a number. This corresponds to the coordinates in the **Mission Planner** map (see p. 1.11 for details).

Player Helicopter. Your helicopter appears in the center of this MFD as a small aircraft icon. When you change bearings, the icon rotates to reflect your current compass direction. The top of the map represents north, the right side east, etc.

Mission Clock. The lower right corner of the digital moving map shows how much time has elapsed since the mission started.

Waypoint Information. Mission waypoints (if in range) appear as circles with numbers; the currently selected waypoint flashes. Lines showing your flight route appear in the display. The box in the lower left corner gives navigation information – the selected waypoint (such as W03) and the distance in kilometers. **Time to Arrival** also appears.

Zoom Level. Current map zoom level in kilometers. This MFD is linked to the TSD — if you change the zoom level here, it is also reflected in the TSD radar range.

Pg Dn Switch map zoom (also TSD range) to 2, 5, 10, 25 or 50 kilometers

TARGETING AND SIGHT SYSTEMS

The AH-64D Longbow and Kiowa Warrior have several systems that aid in acquiring and identifying targets. Both have night vision systems that aid pilots at night and during bad weather.

The Longbow has a Fire-Control Radar (FCR), Target Acquisition and Designation Sight (TADS), and Pilot Night Vision System (PNVS). The Kiowa has a Mast-Mounted Sight (MMS), Pilot Display Unit (PDU), and ANVIS night vision system (similar to PNVS). These systems are discussed in more detail in the following sections.

Mast-Mounted Longbow Fire-Control Radar (FCR)

Longbow

The most significant new system of the AH-64D is the mast-mounted Longbow radar system. This bulbous addition sits atop the rotor shaft (above the blades) and provides 360° scanning capabilities.

Interfacing with the Longbow radar is the Fire-Control Radar (FCR) targeting system, which uses the radar to scan 90° for ground targets (360° for air targets), then “memorizes” them. It can identify and store up to 256 separate targets (stationary or mobile ones) and has both an air and ground radar mode.

The FCR system also classifies and prioritizes targets. It can detect a variety of targets in both a 360° air radar mode and a 90° ground radar mode. The FCR “memorizes” contacts when you bob up, stores the data, and can transmit this information to other helicopters, airplanes or command posts via a wireless data modem. Target information also displays on two separate tactical MFDs (Radar and TSD pages).

Target Acquisition and Designation Sight (TADS)

Longbow

The second target acquisition system in the AH-64D Longbow is the Target Acquisition and Designation Sight. Like the FCR, it allows the crew to identify and target enemy aircraft or ground vehicles from the air. (However, it can only lock onto targets in a 220° arc in front of the helicopter.) The entire sensor system is housed in a turret on the helicopter's nose and includes camera systems that allow daytime and nighttime target acquisition. Also, the TADS contains a laser designator and range finder, which are used to identify targets for laser-guided missiles.

TADS CAMERA CONTROL

When the aircraft is being flown by a single human pilot, the TADS is controlled by the computer co-pilot/gunner, who searches and prioritizes targets.

You have the choice of using the FCR or TADS system when acquiring targets.

Home — Switch between FCR and TADS target acquisition
(The active system appears in Weapons MFD and in the High Action Display – 10, p. 2.14).

TADS and MMS Cameras

Longbow, Kiowa

TADS (Longbow). The TADS/PNVS turret houses the Direct View Optics system (DVO), the Daylight Television system (DTV) and the Forward-Looking Infrared system (FLIR). The view you see in your TADS MFD is an image that has been picked up by one of these turret cameras. The turret can rotate 220° horizontally, and +30° or -60° vertically. Sensors in the turret relay information through an optical tube to the cockpit.

During night missions, the FLIR camera in the TADS/PNVS turret can provide backup night vision to the pilot in case the Pilot Night Vision Sensor system fails.

MMS (Kiowa). The MMS assembly consists of a low-light level TV camera, a digitally enhanced thermal imager and the laser range-finder and designator. Although the ANVIS night-vision system is separate from the MMS, the system is equally capable of target acquisition in the day or night.

Numpad

8, 2, 4, 6 — Hold down to pan the TADS/MMS MFD camera

Alternatively, left-click-and-hold (🖱) the mouse in the MFD and drag it the desired direction.

As a third option, hold down Alt and move the joystick in the Head-Down Display (see p. 2.53).

5 — Recenter the TADS / MMS MFD camera

Pilot Night Vision System (PNVS) / ANVIS

Longbow, Kiowa

Another camera (just above the TADS cameras) is the Pilot Night Vision System (PNVS). It receives thermal images from an infrared camera and lets the pilot fly the helicopter at night or in bad weather/smoky situations. This camera creates a picture of the terrain and ground objects by monitoring the amount of heat emitted from them. In the day, buildings and objects absorb heat and radiation from the sun. After sunset, the camera picks up heat waves radiating from these ground objects. The "heat signatures" mark the location of ground targets and accurately describe the target type.

The Kiowa Warrior uses a thermal imaging system called ANVIS, which performs the same functions as the PNVS.

P — Toggle PNVS/ANVIS camera on/off (use at night or in bad weather).

The PNVS turret camera moves independently of the TADS camera. In the real world, this allows the pilot to move his helmet and receive imagery from one direction while the CP/G moves his helmet in a different direction and views something else. This occurs in the game as well, except that you can control both views.

Kiowa Pilot Display Unit (PDU)

Kiowa

The Pilot Display Unit (PDU) is the Head-Up display for the Kiowa Warrior. It is essentially a small glass display mounted in front of the pilot's seat of the Kiowa Warrior. The PDU automatically and continuously displays targeting and weapon constraint information, some of which is also accessible in the VSD MFD (see p. 2.41 for details on this MFD).

Numpad 0 — Toggle between pilot's seat (on the left) and CP/G's seat (on the right)

Target Box. Once you have a target in your field of view, a small green box appears around it. If the target moves out of view, the box disappears. To gain a firing lock on that target, maneuver the helicopter so that the target box moves under the PDU weapon constraint. Your weapon constraint will turn solid (described in the next paragraph).

Weapon Constraint. The PDU displays a weapon constraint. Its appearance differs, based on whether you have the machine gun, Hellfires, Stingers or rockets active. See **Kiowa Weapon Constraints**, p. 2.49.

Kiowa Weapon Constraints

Additional weapon-specific items are added to the PDU display when you use your weapons. It doesn't matter which master mode is currently active — it all depends on the current weapon type. To tell which weapon is active, look at the VSD MFD — an icon appears for whichever weapon you're using.

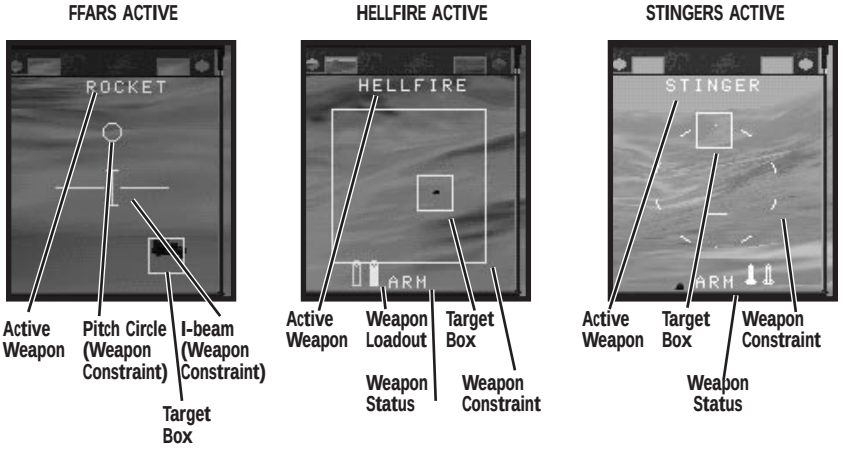
Bksp	Select active weapon (cycle through Hellfires, rockets and Stingers)
Ctrl M	Toggle weapons between ARM (active) and SAFE (inactive)
Spacebar	Fire active weapon
Enter	Fire cannon

Gun Constraint. When you have the machine gun active, cross hairs appear on your PDU. However, you can't slew the gun as you can in the Longbow. This means that you need to maneuver so that the target box is under the cross hairs. When the cross hairs turn from dashed to solid, you can fire.

The number of rounds remaining appears in the lower left corner of the VDU when the gun is active.

Hellfire Missile Constraint. Specific to Hellfire missiles, this constraint box remains stationary in the PDU. It is dashed when you're out of constraints (don't have a weapon lock) and turns solid when you can fire.

To bring the target into constraints and acquire a lock, you must maneuver your helicopter so that the target box moves under the dashed missile constraint in the PDU. When you correctly align the target with the constraint, the missile gains a valid lock, and the constraint border turns solid.



Rocket Steering Cursor. When rockets are active in the Kiowa, two separate weapon constraint items appear on the PDU. These constraints apply only to multi-purpose submunition (MPSM) rockets — FFARs do not require a lock.

The rocket constraints only display if rockets are active, and both constraints must be met to gain a lock. The first constraint is an I-beam, which shows what direction the helicopter needs to move horizontally to bring the target into weapon constraints. Swing the helicopter right or left until the target box is under the PDU, and the I-beam is centered on it.

The second constraint is a pitch circle, which indicates vertical alignment. Nose the helicopter up or down until the target box is under the PDU, and the circle is centered on the target.

Once you've aligned both elements, you can fire your MPSM rockets. You can't fire, however, if you're out of range, if you don't have the I-beam and circle correctly aligned over the target, or if the Master Arm indicator is set to SAFE (press Ctrl M to arm weapons).

ATA Missile Constraint Circles. When the air-to-air (ATA) missile system is active, a large circle appears on the display and indicates where the missile seeker head is looking. The circle turns solid when the target meets the weapon constraints, and remains dashed if it has not. Bring air targets into the center of the circle to gain a missile lock.

CO-PILOT/GUNNER COCKPIT

Longbow, Kiowa

Both the Longbow and the Kiowa feature a separate cockpit for the co-pilot/gunner (CP/G). In the Kiowa, the two seats are virtually identical. In the Longbow you can perform most of the same tasks in the front (CP/G) seat as you can in the pilot's seat — the main difference is that the CP/G seat has an *Optical Relay Tube (ORT) Unit.*

Uses for CP/G Cockpit

Unless you're flying specifically as a CP/G in a multi-player scenario, you don't *have* to use the second cockpit. The Kiowa's CP/G really doesn't have any advantages over the pilot's seat. In the Longbow, however, the greatest advantage is that you can display different MFDs in each cockpit. Typically, offensive MFDs are most useful in the CP/G cockpit, defensives ones in the pilot's cockpit. In the Longbow, the cockpit dash view of the ORT is only visible in the front (CP/G) seat (between the left and right MFDs).

If you are flying in a multi-player scenario, with both a human pilot and a human CP/G, you may wish to keep in mind that according to Army SOP, the highest-ranking person in the helicopter occupies the CP/G seat under normal circumstances. This is because he is in the best position to know whether the mission has been accomplished, gauge the general battlefield situation, and determine in an emergency situation whether to proceed with the mission or bug out.

Kiowa's Left Seat (CP/G)

The co-pilot's seat in the Kiowa is functionally identical to the pilot's. The only differences are that the single MFD appears on the opposite side of the panel, and the PDU doesn't appear. Kiowa pilots and CP/Gs share the same Digital Moving Map display (see p. 2.45 for map details).

Numpad 0	Toggle between left seat (CP/G) and right seat (pilot's cockpit)

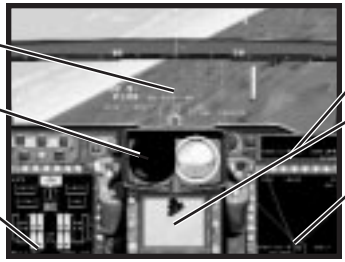
KIOWA LEFT-SEAT DASH

Longbow's Front Seat (CP/G)

The full-screen view of the ORT, called the Head-Down Display (HDD), shows TADS or Radar MFD image (whichever is active) with target information superimposed on top of it. This screen is repeated in a small, cockpit dash display known as the Head-Out Display (HOD) – a monochrome image that duplicates the HDD.

Numpad [0] Toggle between front-seat (CP/G) and pilot's cockpit

Numpad [.] Toggle HDD mode (between full-screen or repeater mode) from the CP/G cockpit



IHADSS Normal IHADSS information appears in this cockpit.

MFDs The front-seat cockpit has two MFDs.

UPFRONT Text Display The top half gives damage information (and target information, if [U] is active). The bottom displays the elapsed mission time.

Optical Relay Tube Unit (ORT) The ORT shows either the TADS or Radar MFD. You can view ORT information on a small screen in the cockpit (Head-Out Display), or in full-screen mode (Head-Down Display) by pressing Numpad [.] (toggle).

IHADSS/MFDs/UPFRONT Display

Longbow

The IHADSS display, MFDs and UPFRONT display operate just as they do in the back seat. You still switch the left and right MFDs normally (with [<,] and [>.]), and but you can have different MFDs open in each cockpit.

Optical Relay Tube (ORT) Unit

Longbow

In addition to two regular MFDs, the Longbow's CP/G cockpit has an ORT unit that shows either the TADS or Radar MFD. The CP/G performs his targeting functions by either looking through the HDD (an eye-piece mounted in the middle of the cockpit dash) or at the HOD (small dash display).

Head-Out Display (HOD)

The Head-Out Display emulates either the TADS or Radar MFD, depending on which acquisition mode is active. If TADS is the active target acquisition system, the TADS page appears. If you have FCR active, the Radar page appears.

See **Radar MFD** (p. 2.29) and **TADS MFD** (p. 2.32) for ORT view commands specific to these MFDs.

Head-Down Display (HDD)

Longbow

You can "look" through the optical relay tube in the front-seat (CP/G) cockpit by using the Head-Down Display. When you do so, target information normally available in the TADS and Radar MFDs is superimposed over camera imagery in a full-screen view.

Your current airspeed appears in the upper left corner of the High-Action Display in this view. Current altitude appears in the upper right.

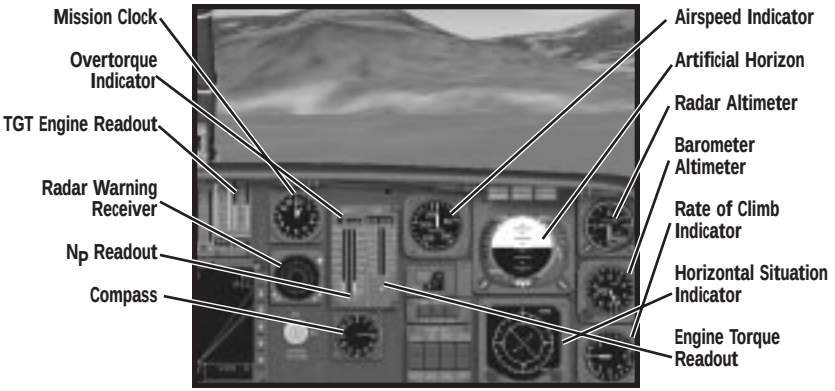
When you're *not* in HDD view, ORT information appears in the HOD dash display.

Numpad . Toggle ORT display between Head-Down / Head-Out view.
The HDD view displays a full-screen TADS or Radar MFD (whichever system is active).
Press again to return to HOD (dash) view.

BLACK HAWK ANALOG COCKPIT

Black Hawk

The cockpits of the Longbow and Kiowa are almost entirely digital, with all important flight-status information appearing in the MFDs or Upfront display. The Black Hawk, however, has far fewer digital readouts, and relies far more on traditional analog aircraft instrumentation.



Cockpit Gauges

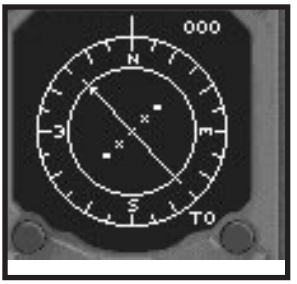
The following appear as dial gauges or bar readings built into the cockpit of the Black Hawk.

Airspeed Indicator. Dial gauge that shows how fast the helicopter is traveling in knots. A knot is a nautical measure of speed, approximately equal to 6076 feet/hour (a distance equal to one nautical mile). The indicator scale ranges from 0 to 250 knots.

Altimeter. Dial gauge that gives the helicopter's altitude in feet above sea level (which differs from height above ground level). Keep in mind that this reading might indicate 2000 feet above sea level, while your ground altitude may show much less than that — the ground is usually higher than sea level.

Radar Altimeter. Dial gauge that measures altitude, up to 1500 feet above ground level. (It uses a primitive radar to bounce signals off of the ground, then measures how long it takes for signals to return. The scale is logarithmic.)

Horizontal Situation Indicator. This gauge indicates how far off course you might be at any given moment. The outer ring of the HSI has a compass, while the line bisecting the inner ring represents the direct path of your assigned course. A deviation bar shows (in relative terms) how far you are from your course. If the course bar is perfectly vertical, and your deviation bar exactly overlays the course line, then you are on course.



Torque Readout. Gauge that indicates how much engine power/torque is currently being produced by each engine. When the collective is adjusted, the power and torque change accordingly.

TGT Engine Readout. Gauge that indicates the temperatures of the left and right engines.

N_P Readout. Gauge that displays revolutions-per-minute readings for the left and right turbine engines.

Radar Warning Receiver (RWR). Electronic display that identifies radar-emitting sources. When a threat is detected, lines emanate from the center of the RWR in the direction of the threat. The longer the lines, the greater the severity of the threat (as estimated from its radar signal).

Compass. A magnetic compass showing the current heading of the aircraft.

VIEW CONTROLS

Longbow, Black Hawk, Kiowa

During flight, you have access to a number of useful views. You can "look" in any direction, watch your missile as it strikes a target, slew your TADS helmet view, pan around your aircraft, and more.

Alternate views are both useful and entertaining. All game objects are highly detailed (down to their rotating turrets) and are active even while you're occupied elsewhere. You can even hear their sound effects in exterior camera views. Using these views helps you keep track of what's going on in the combat environment.

View Panning

You can pan the view in any exterior view (outside of the cockpit) as described below. You cannot, however, pan to an upside-down view.

Numpad 8	*Tilt camera up*	Tilt any exterior view up slightly.
Numpad 2	*Tilt camera down*	Tilt any exterior view down slightly.
Numpad 6	*Pan right*	Rotate any exterior view to the right.
Numpad 4	*Pan left*	Rotate any exterior view to the left.
Numpad 5	*Reset view*	Return view to default (centered) position.
Numpad +	*Zoom in*	Zoom in any exterior view.
Numpad −	*Zoom out*	Back out any exterior view.
Alt + joystick	*Tilt/Pan view*	Tilt or rotate any exterior view.

Inside Cockpit Views

Note: *The "no cockpit" views listed below keep the IHADSS display in your view at all times.*

F1	**Front cockpit view.** Looks out the front of the cockpit.
Shift F1	**Front view, no cockpit.** Removes cockpit/MFDs and shows only IHADSS. You can pan this view without affecting the TADS sensor/cannon position. (See **View Panning**, above, for controls.)
F2	**Left cockpit view.** Looks out the left side of the cockpit and displays IHADSS information.
Shift F2	**Left view, no cockpit.** As F2, but without cockpit art.
F3	**Right cockpit view.** Looks out the right side of the cockpit and displays IHADSS information.
Shift F3	**Right view, no cockpit.** As F3, but without cockpit or MFDs.
F4	**Virtual cockpit / target lock view.** The first press of F4 puts you in a "virtual cockpit" view looking straight out the aircraft's wind screen. A second press, however, will lock your view to the closest target (in the Longbow, your cannon automatically aims itself at this target). Subsequent pressings cycle the view through available targets.

Exterior Views

F5	**Chase view.** Views your helicopter from a fixed position behind the tail rotor. (The camera "chases" your helicopter.) Pressing this key multiple times cycles to an exterior view of the left side, an exterior view of the right-side, and then returns to the chase view.
Shift F5	**Fly-by view.** Views your helicopter as it flies by the camera.
F6	**Next object view.** Cycles through all objects in this order: aircraft, ground vehicles, inanimate ground objects.
Shift F6	**Previous object view.** Cycles through all objects in reverse order.
F8	**Player missile view.** Switches to your missile's viewpoint.
Shift F8	**Player missile view toggle.** Automatically switches to your missile's viewpoint anytime you launch one.
F9	**Incoming missile view.** Switches to the viewpoint of an approaching missile when it closes in on you.
Shift F9	**Incoming missile view toggle.** Automatically switches to the viewpoint of any missile that is approaching you.
F12	**Death view.** Switches to exterior view of a recently destroyed target.
Shift F12	**Death view toggle.** Automatically switches to exterior view of a target when it's destroyed.

Note: *All of the "toggle" switches (Shift F8, Shift F9 and Shift F12) cause the view to change automatically under the appropriate conditions. The name of the camera and its new status briefly displays on the IHADSS (for example,* DEATH CAMERA ON*).*

Target Views

The next six views cycle through a current target list (a list of targets identified by the FCR, TADS or CP/G). This list varies, depending on which system you're using to find targets, and whether or not you've established any Priority Fire Zones (PFZs).

- Switching targets in view (by pressing T) transfers the current lock to that target instead.
- If you're using FCR target acquisition and have designated PFZs, the view cycles through targets in that zone.
- If you're using FCR target acquisition and have no PFZs, the view cycles through whatever targets the FCR currently has stored.
- If you're using TADS target acquisition, the view cycles through targets identified by the TADS sensor.

F7 — **Next target view.** Displays a side view of the next target in your target list.

Shift F7 — **Previous target view.** Displays a side view of the previous target in your target list.

F10 — **Player-to-next-target view.** Tactical view that lines you up with the next target in the list (the camera "sees" you, then the enemy, in a direct line of sight). Subsequent presses cycle through other targets.

Shift F10 — **Player-to-previous-target view.** As above, except that it cycles to the previous target in the list.

F11 — **Next-target-to-player view.** Tactical view that lines your previous target up with you (the camera "sees" the enemy, then you, in a direct line of sight). Subsequent presses cycle through other targets in the list.

Shift F11 — **Previous-target-to-player view.** As above, except that it cycles to the previous target in the list.

3
Ground School

3. GROUND SCHOOL

Although records of experiments in rotary flight date back to the 15th century, it wasn't until after World War II that a full-size model of a helicopter capable of consistently flying more than a few hundred feet was developed. Early attempts at helicopter design were thwarted by a lack of understanding of the physics of rotary flight and the special problems it created.

This chapter describes the forces that govern rotary-wing flight. The first section provides an overview of the basic aerodynamic principles of lift. The next sections explain the interaction of the forces and velocities inherent to the rotational motion of the blades and the horizontal motion of the aircraft.

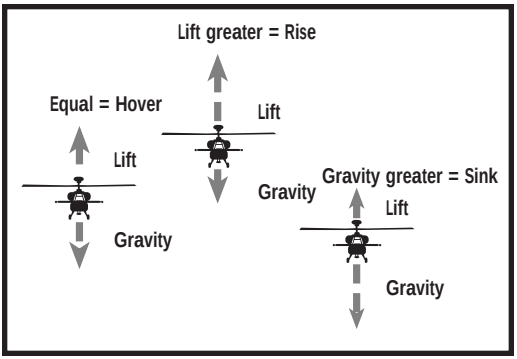
Boxed text provides examples or additional, more detailed information in some sections.

LIFT FORCE

For now, let us ignore forward movement, and look at two basic aerodynamic forces that allow a helicopter to get off the ground and hover.

Gravitational force. The most fundamental force you encounter is *gravitational force*, the force that pulls everything toward the center of the earth.

Lift. The *lift* force counteracts gravity, and is created as a result of air flowing over a wing or blade surface.



When lift is greater than the gravitational force, the aircraft rises. When lift is less than gravitational force the aircraft sinks. When the two forces are equal, the aircraft hovers.

When we talk about the weight of an object, we are actually talking about strength of the gravitational force pulling it toward the earth. Thus, as an object gets lighter or heavier, the strength of the gravitational force acting on it decreases or increases.

The heavier an object, the greater the lift force needed to keep it in the air. Thus a fully loaded helicopter must generate more lift than an empty one. Also, as a helicopter flies, it burns fuel, and thus becomes lighter, requiring a smaller lift force.

Generating Lift

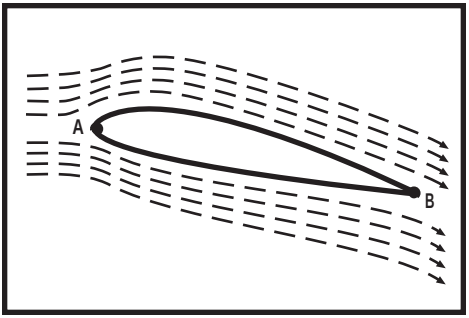
The design of an aircraft's *airfoils* (wings or blades) enables them to generate lift. Airfoils are designed differently for each application — rotary-wing airfoils are built to take advantage of both forward flight and rotary motion. The geometric design of the blade helps the craft adapt to variable flight conditions.

Two physical principles, *Bernoulli's principle* and *angle of attack*, explain how the design of an airfoil creates lift.

Bernoulli's Principle

Bernoulli's principle states that as the speed of a fluid increases, its pressure decreases. Air acts much like a fluid as it flows around an airfoil. It separates and flows both under and over the exterior surfaces. (The point of separation is called the *point of impact*.) Differences in the speed of the air flowing across the upper and lower surfaces of the airfoil create differences in pressure, which in turn create lift.

In the diagram below, notice that the path from A to B along the top surface of an airfoil is longer than the path between these two points along the bottom surface.



Because the upper surface of an airfoil is longer than the lower one, air must travel a greater distance over the top surface. Since the upper and lower surfaces move through the air in the same amount of time, the air must travel faster over the upper surface to cover this greater distance. According to Bernoulli's principle, this difference in airspeed creates a higher pressure beneath the airfoil and lower pressure above it. Since slightly more pressure is present below the airfoil, the airfoil is pushed upward. This upward force is called *lift*.

Two consequences of Bernoulli's principle affect the *amount* of lift generated by an airfoil:

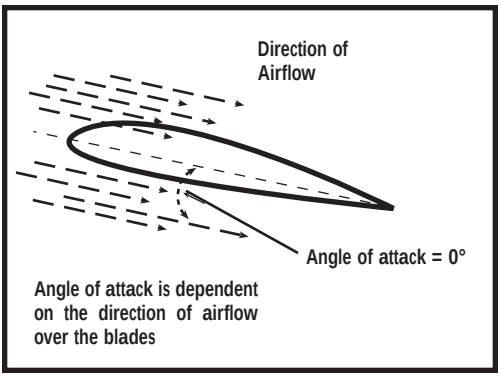
- At faster speeds, the pressure differential above and below the airfoil is greater. The faster an airfoil moves through the air, the more lift it generates.
- At higher altitudes, the air becomes thinner (less dense) and thus generates less pressure and less lift.

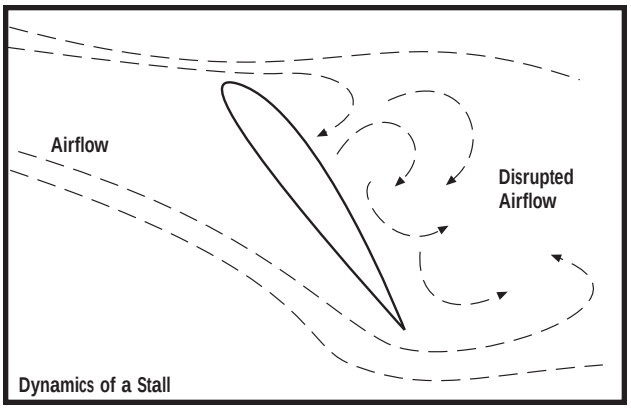
Angle of Attack

When a helicopter powers up, its blades are parallel to the ground. Once they're spinning fast enough, the pilot angles the blades. When the blades cut through the air at an angle, they generate lift.

The angle at which the blade hits the air is called the *angle of attack.* This angle changes as the pilot changes the angle of the blades with his flight controls and as the direction of the air moving over the blades changes (as, for example, in gusty wind conditions).

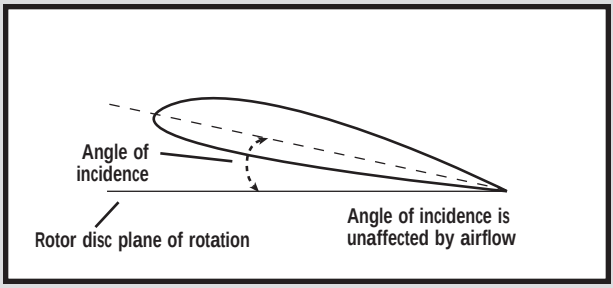
To understand how blade angle of attack increases lift, imagine holding your hand outside a car window while the car is moving. If you hold your hand so that your palm faces the ground, the edge of your hand cuts through the air with relatively little resistance. If you hold your hand perpendicular to the ground, the force of air rushing against your palm pushes it back. But if you angle your hand so that its front edge is tilted slightly upward, the force of air will push your hand slightly up as well as back.





Similarly, when air moves over an angled blade, the force of the air pushes it slightly upward, contributing to the total lift force on the aircraft. The lift force generated increases with the angle of the blade — up to a point. As you saw with your hand, there is a point at which angle of attack becomes too steep, when the flow of air over the blade is disrupted and the force pushing the blade backward is greater than the force pushing it up. The blade is no longer generating lift. This is known as a *stall.*

Angle of Incidence



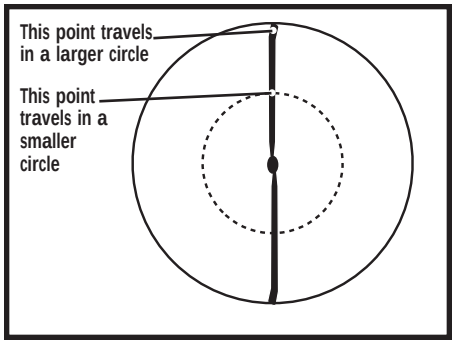
Angle of incidence refers to the angle of the blades with respect to the plane of rotation of the rotor disc. This angle is strictly mechanical and is not affected by differences in airflow. This is the angle that the pilot alters with flight controls. The *collective* alters the angle of incidence of all of the blades to the same degree at the same time. The *cyclic* control changes the blades' angles of incidence differentially at various points along the path of rotation, causing the plane of the entire rotor disc to tilt. (If the pilot pushes the cyclic forward, the angle of incidence of the blades is greater when they are passing over the tail than it is when they are passing over the nose. This tilts the entire rotor disc forward.) See **Collective Stick** and **Cyclic Stick**, pp. 4.2 - 4.3.

ROTATIONAL MOTION

As stated earlier, lift is an upward force created as an airfoil cuts through the air. In a helicopter, the airfoils (blades) move through the air in three directions — horizontally, vertically and circularly. The interaction between forces generated by these planes of motion determines how the helicopter moves.

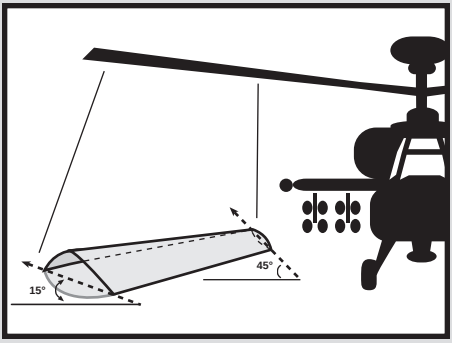
The speed of the blades as they rotate around a central point is called *angular* or *rotational velocity* or *blade speed*. The velocity of air moving over blades varies along the length of the blades, which in turn means that the lift force varies along the length of the blades. This phenomenon is known as *dissymmetry of lift.*

Dissymmetry of Lift



Basic geometry tells us that the greater the circumference of a circle, the greater distance a point along the circle has to travel to make a single revolution. Points along a helicopter blade are simply points traveling in concentric circles around the rotor shaft. The paths traveled by points at the tip of the blade are much longer than the paths of points near the center, but the entire blade completes a rotation at the same time. This means the points at the tips on the blade are moving faster than the points near the rotor shaft.

Since the sections of the blades near the rotor shaft move more slowly, less lift is produced in the area near the rotor shaft (see **Bernoulli's Principle**, p. 3.2). The difference in the amount of lift generated by different sections of a helicopter blade is called *dissymmetry of lift.*



To compensate for dissymmetry of lift, helicopter blades incorporate a twist toward the interior of the blade. This increases the pitch angle of the blade as you near the rotor shaft, and therefore creates more lifting force. This causes lift to be created evenly throughout the entire length of the rotor blade.

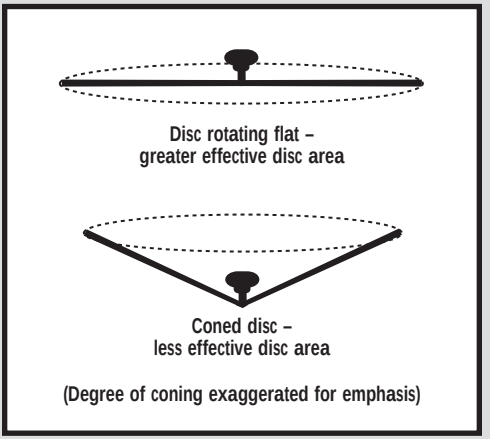
Compressibility of Air

It makes sense that the faster the blades spin, the more lift can be created. This holds true until the blade speed nears the speed of sound. Air compresses around the blades and produces a shock wave on the bottom surface at blade speeds between Mach 0.5 and 0.6, and on the top surface at blades speeds near Mach 0.9. This phenomenon is called *compressibility of air*. A helicopter's blades are not designed to go through this shock wave and the resulting pitch force.

Mach 0.9 is generally accepted as the maximum blade speed for a helicopter; this translates to about 200 knots forward airspeed. (Air compression effects create a problem for helicopters at much lower speeds than for fixed-wing aircraft because the speed of the advancing blades on a helicopter is actually the sum of the forward airspeed and the blades' rotational velocity. See **Asymmetry of Lift**, p. 3.10.)

Coning

As more lift is generated by the helicopter, the blades rise above the horizontal position and assume a cone-like position. This happens because lift is applied to the entire blade, but only one end of the blade is free to move up (or down). So, all of the lift applied to the blade acts on the blade tip.



The greater the degree of coning, the less lift is produced. This is because once the rotor blades are coned, the amount of effective disc area decreases. The effective disc area is the area covered by one revolution of the blade. If the blades are coned, they "shorten" the diameter of the disc.

Downwash

As the rotor blades spin, they push air downward. Air just outside the rotor disc flows up, arcs over, and is pushed down through the rotor disc. This flow of air is called *induced flow* or *downwash*. Downwash doesn't present problems during normal flight and gradual altitude changes; it can even be used to increase lift during a hover. However during steep descents (exceeding 30°) downwash can be fatal.

Ground Effect in a Hover

When a helicopter hovers within a rotor length of the ground, downwash pushes down against the surface. An artificial cushion is then created as the air "bounces" off the terrain and back up into the rotor blades. This is called *ground effect.*

In the game, you'll notice ground effect when you're flying within 50 feet or so of ground level. Look at the torque indicator (which indicates the engine's power output) when hovering at 50 feet, then again when you're hovering above 100 feet.

The difference in engine torque required to sustain lift at these altitudes is due to ground effect.

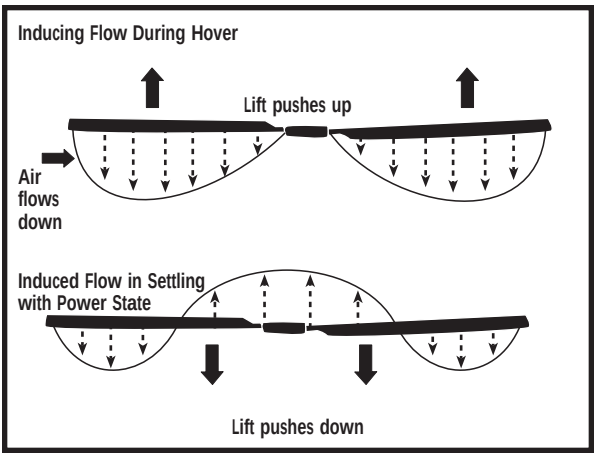
Within a ground effect cushion, less power is required to keep the helicopter aloft because downwash bouncing off of the ground adds to the lift produced by the spinning rotor blades. When hovering inside ground effect, pilots can decrease the collective angle of the blades and reduce engine power. Hovering outside ground effect requires more power than any other helicopter maneuver.

Smooth surfaces (like asphalt or concrete) generate a better cushion. Rougher terrain tends to distort the air flow and make the cushion less uniform.

Settling with Power

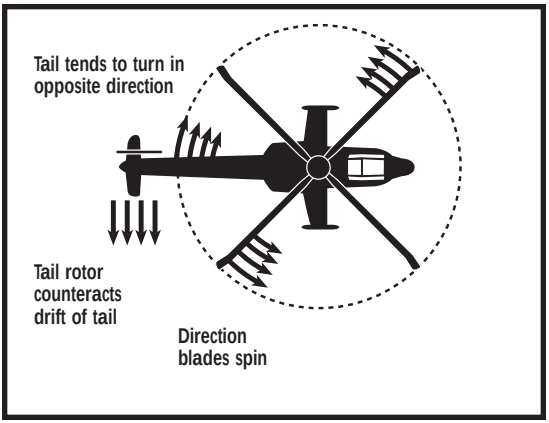
If a helicopter makes an extremely fast descent with little forward velocity, it can get caught in its own downwash, and the pilot may find it difficult to generate enough lift to break the descent. This condition is called *settling with power*, also referred to as the *vortex ring state.*

When a helicopter settles with power, its descent rate exceeds the airspeed of the downwash. This means that airflow under the inner section of the rotor disc is no longer creating lift — air is actually flowing upward relative to the disc. Lift is being created in the wrong direction, pushing the craft down in the direction of descent.



Torque

A bizarre function of early helicopter models frustrated designers for centuries. Whenever a model took off, it would keel over in one direction or spin and hop uncontrollably. This behavior was later understood to be the result of a torque force: the rotor shaft was spinning in one direction, while the rest of the craft was twisting in the opposite direction.



Why does torque occur? Newton's Third Law of physics states that for every action, there's an equal and opposite reaction. In this case, the reaction is torque. A helicopter body spins opposite the direction its rotor is spinning.

Tail Rotor

The Longbow Apache has a tail rotor to counteract torque. The pilot uses directional control pedals to apply force in the opposite direction of the torque created by the spinning blades. The tail rotor generates this force in the same way the main rotor generates a lift force – the directional control pedals increase/decrease the blade angle of attack, which in turn increases/decreases the amount of force the tail rotor creates. The tail rotor can also be used to yaw the aircraft in a hover and sharpen turns (see **Directional Control Pedals**, p. 4.4).

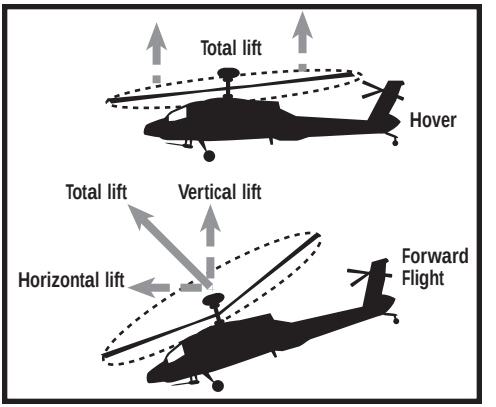
Hovering and Translating Tendency

During hovers, helicopters with a tail rotor tend to drift to one side because the tail rotor "pushes" the craft sideways. This is called *translating tendency*. Helicopters with blades that rotate counterclockwise (most helicopters built in the U.S.) drift to the right. To compensate for this drift, the pilot can tilt the entire rotor disc to the left. This causes the main rotor to apply more force against the tail rotor.

Some modern helicopter designs have built-in features that take translating tendency into account. The main rotor may tilt slightly to the left when the cyclic control is centered. Or, the control system may tilt the rotor to the left when collective is increased during a hover. (See **Collective Stick** and **Cyclic Stick**, pp. 4.2 - 4.3, for more information.)

HORIZONTAL MOTION

Unlike a fixed-wing aircraft, which is propelled forward by thrust from the engines, a helicopter moves forward (or backward, or sideways) by tilting the lift force.



To move forward, a pilot adjusts his cyclic control (see **Cyclic Stick**, p. 4.3), which adjust the angles of the individual blades as they rotate so that the entire rotor disc (the plane of rotation of the rotor and blades) remains tilted downward (see diagram). When the aircraft hovers, the rotor disc remains parallel to the ground and all of the lift force it generates pushes the aircraft up. When the rotor disc is tilted, the lift force is also tilted. When the disc is tilted as in the diagram above, more lift is being generated in front of the helicopter than behind it, and the helicopter moves forward.

Because some of the lift force is being directed forward when a helicopter is moving forward, the vertical component of the lift force is smaller. Thus more *total* lift must be generated to keep the aircraft moving forward at a constant altitude. The same thing happens when you are turning (rolled to one side), as the lift force is shifted to the side.

Translational Lift

Lift is initially produced as the rotor blades spin and their angled surfaces cut through the air. When the helicopter switches from a hover into forward motion, air passes over the helicopter from nose to tail. This air moves over the spinning blades as well, creating additional lift. Lift created by the horizontal motion of a helicopter is called *translational lift*.

Just as more “normal” lift is produced at higher *blade* speeds, more translational lift is produced at higher *air*speeds — up to a certain point. Translational lift kicks in at speeds near 20 knots, and, in the Longbow Apache, reaches a maximum level at about 60-70 knots. Since this speed produces the best lift, it is the speed at which the Longbow Apache achieves the best climb rate. Beyond this speed, more power is required to overcome the effect of air resistance (or drag) against the blades, and the amount of lift generated decreases.

Drag

Commonly known as air resistance, drag is the force that counteracts an object moving through air. As an airfoil moves through the air, the air resists the surface of the airfoil, pushing against it. The upward component of this force produces lift. The backward force, however, is a drag force that works against the forward motion of the blades. This drag force increases as angle of attack increases. (See **Angle of Attack**, p. 3.3.)

Drag produced by angle of attack is called induced drag. No airfoil can generate lift without also generating drag. And just as greater speed produces a greater lift force, it also produces greater drag.

Asymmetry of Lift

Blade speed and lift become more complicated when a helicopter moves horizontally, because the blades of the helicopter are revolving in a circle, and their rotational velocity adds to or detracts from their horizontal velocity at different points in the rotational cycle.

During half of the rotation, the blades are moving toward the nose of the helicopter. During the other half, they are moving toward the tail.

The blades moving toward the nose (advancing blades) are traveling forward at some speed. If the helicopter moves forward at a certain speed, its blades also move forward at this same speed. For the advancing blades, the sum of these two speeds equals the speed of the air passing over the blade.

The blades that are moving away from the nose (retreating blades) are actually moving in the *opposite* direction of the helicopter. In this case, the speed of the air passing over the blades is the helicopter's forward airspeed *minus* the speed at which the blades are moving toward the tail.

Since the speed of the blade is faster during part of the blade's revolution, the amount of lift it creates fluctuates. More lift is created by advancing blades, and less lift is generated by retreating blades. This causes *asymmetry of lift*, meaning that the lift force on one side of the rotor disc does not equal the lift force on the other side.

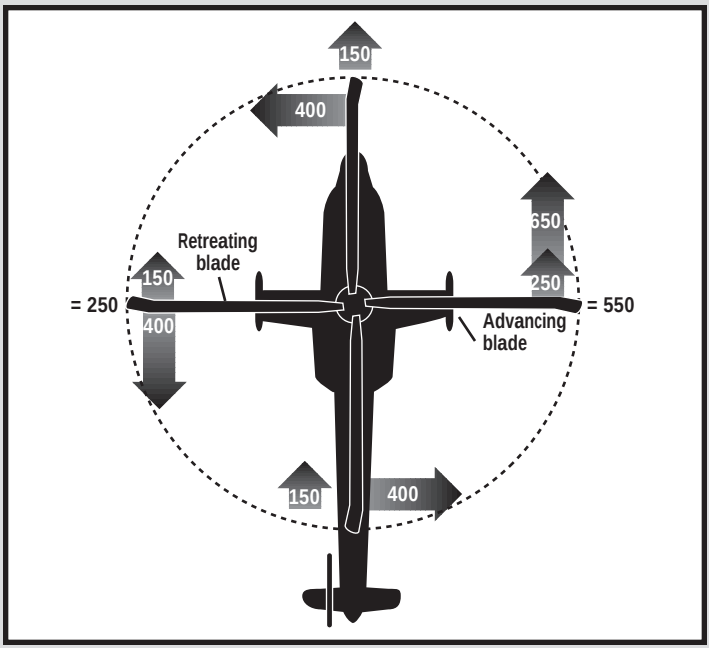
Assume that a helicopter with only two rotor blades is traveling forward at 150 mph, and that the outer tip of the rotor is spinning with an angular velocity of 400 mph. The position of the blades in their circular path will be described by the "time" convention, where 12 o'clock is the nose of the helicopter and 6 o'clock is the tail.

As one blade moves from 12 o'clock (the nose) to 9 o'clock, it is traveling from the front of the aircraft toward the rear. This is called the retreating blade because it is moving "backward" relative to the forward motion of the helicopter.

The other blade moves from the rear of the aircraft toward the front (from the 6 o'clock position to 3 o'clock). It is the advancing blade because it is traveling "forward," or in the same direction as the helicopter's motion.

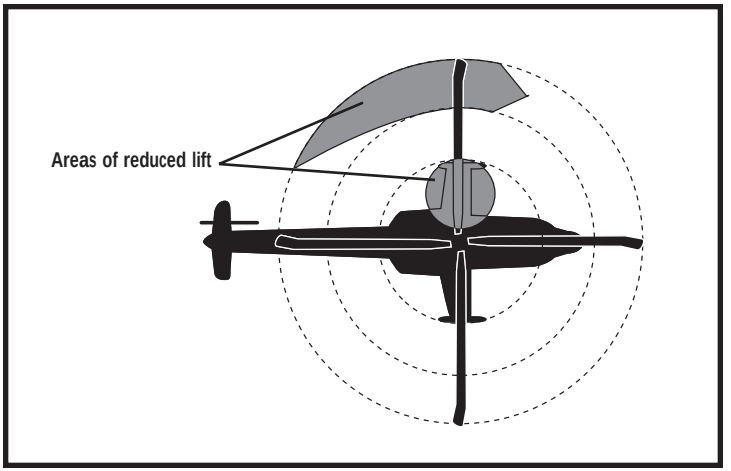
The advancing blade is moving in the same direction as the helicopter (forward), so the speed of the air passing over the blade is the sum of these two speeds (150 + 400 = 550 mph). The retreating blade is moving in the opposite direction of the helicopter, so the speed of the air passing over it is the difference between the speed of the advancing helicopter and the speed of the retreating blade (400 - 150 = 250 mph).

Now, return to a basic principle of lift — more lift is created at higher airspeeds. The speed of the advancing blade is 550 mph, while the speed of the retreating blade is 250 mph. The advancing blade creates more lift, because it's traveling faster. This additional lift only occurs on the side where the blades are advancing. Thus, helicopters in the U.S. tend to veer up to the left. This phenomenon is called *asymmetry of lift*.



Retreating Blade Stall

As the forward speed of the helicopter increases, the airspeed around its retreating blade decreases, which means the lift generated on the retreating blades decreases. In order to compensate for the reduction of lift, the angle of attack of the retreating blades must be increased in order to equalize the lift on both left and right side of the rotor disc. (The pilot does this by moving the cyclic control toward the side where the lift is greatest.) Increasing the angle of attack too much, however, results in a stall (see **Angle of Attack**, p. 3.3). Pockets of stalled air are created near the center and edge of the rotor disc.



The blades stall and then unstall as they move through this region (remember, the same blade retreats and then advances as it rotates). This causes vibrations which warn the pilot that the blades are stalled and might be damaged if the stall condition increases. As you continue to increase airspeed beyond this point, the stalled region grows bigger, the vibrations get worse and eventually either the rotor is destroyed or you roll to one side, since less lift is generated on the stalled side of the rotor.

Autorotational Landing

In the event of engine failure and/or an uncorrectable blade stall, a pilot may be forced to make an autorotational landing. An *autorotational landing* is a landing made without power from the engines. As the helicopter descends, air flows upward through the rotor disc. The rotor system is designed so that this updraft keeps the blades rotating, providing a minimal amount of lift that may allow the pilot to stay up in the air long enough to land without crashing.

For landing instructions, see **Autorotational Landing**, p. 4.14.

4
Flight Training

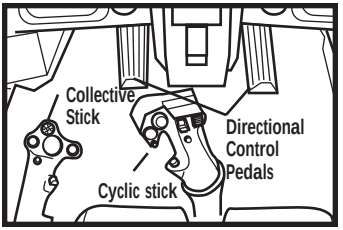
4. FLIGHT TRAINING

This chapter describes the basic controls of the helicopter and the mechanics of taking off, climbing, diving, turning and landing.

- See **In a Hurry?**, p. 0.12, for a short overview of the basic instruments and keystrokes you need to fly *Longbow 2*.
- See **Weapons Systems**, pp. 5.9-5.23, for details on how to use the onboard weapon systems, acquire targets, and arm/fire all of the Longbow's weapons.
- See **Cockpit/Systems**, Chapter 2, for an explanation of all cockpit displays and analog/digital instrumentation.
- See **Training Building**, p. 1.5, to try out the game's interactive tutorial system. You'll learn everything you need to know to fly and fight.

HELICOPTER CONTROLS

Most pilots who have flown both fixed-wing and rotary aircraft agree that flying a helicopter is more difficult than flying an airplane. The characteristics of rotary flight make maintaining a steady course difficult, and pilots must constantly adjust the controls and monitor the surroundings.



Pilots use both their feet and hands to continually adjust three main controls — collective, cyclic and directional control pedals. The collective controls vertical movement; the cyclic controls forward, backward and banking movements; and the pedals change heading.

Note: *Different joysticks support different functions. Please use the appropriate button if it's different from the controls/keys listed in this section.*

Rotor

The helicopter's cyclic and collective controls affect the rotor blades. When the rotor is spinning, changing the angle of the blades controls the amount of lift and the direction in which the helicopter moves.

Before taking off, you must disengage the rotor brake. After landing, you must engage it. If you want to autorotate, you can disengage the rotor (it will still spin). You can also stop the rotor with the rotor brake. However, it stops all circular rotor motion.

R Turn rotor brake on/off (toggle)

Use this key before takeoffs (except in Instant Action Missions), or if you want to stop the rotor from spinning (when you're visiting a FARP or landing).

Ctrl R Engage/disengage the rotor (toggle)

This happens automatically if both engines lose power (so that you can autorotate and maintain rotor RPM – see **Autorotational Landing**, p. 4.14).

Collective Stick

The collective controls lift (and thus altitude) by altering the pitch of all four main rotor blades simultaneously. Use the following keystrokes to simulate the collective stick if you're using the keyboard to fly. If you're using a joystick with an active throttle wheel, you can also use the wheel to control collective.

[+=]	Add collective (increases altitude)
[-_]	Decrease collective (decreases altitude)
Throttle wheel	Move forward to add collective, backward to decrease collective. You can reverse this by selecting the HELICOPTER STYLE COLLECTIVE option in the **OPTIONS** menu (see *Install Guide*).

Advanced Collective Controls

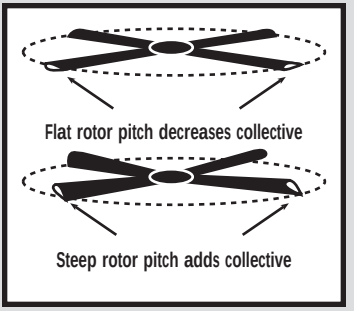
Other keys give you fine collective control. Try them once you get the basics down:

Shift [+=]	Add collective (1%)
Shift [-_]	Decrease collective (1%)
[~`]	Set collective to 0%
[1] through [0]	Set collective from 10% to 100%

Note: *The digital percentage readout in the upper left corner of the IHADSS does not reflect the current collective setting. It reflects the torque percentage.*

How Collective Works

The collective changes the angle (pitch) of the rotor blades "collectively." This means it adjusts all blades at once by the same amount. This is a static change, meaning the pitch of each blade remains constant throughout each blade revolution. Increasing the angle of the blades ("adding collective") increases lift. Decreasing the blade angle ("reducing collective") lessens lift.



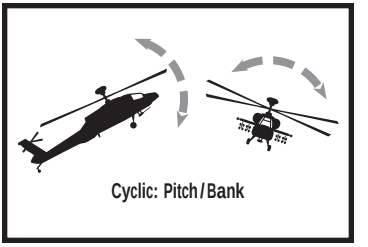
When a pilot adds collective, the helicopter rises vertically. But if too much collective is added, the blade angle can be too steep and create drag instead of lift. This occurs because as collective is increased, the extreme pitch angle of the blade causes the engine to bog down. Easing up on collective produces less lift and results in a gradual descent. As you increase collective, engine torque yaws the helicopter slightly to the right. Lowering torque will yaw the helicopter slightly to the left.

Cyclic Stick

The cyclic controls pitch and bank. Your joystick (or keyboard, if it's the active flight device) acts as the cyclic stick.

↑, ↓ Pitch the aircraft down, up

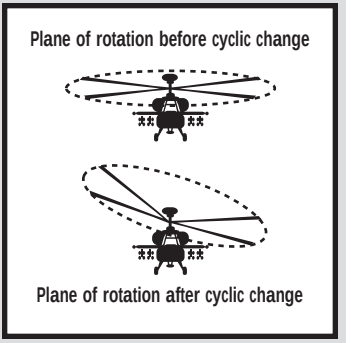
←, → Bank the aircraft left, right



Cyclic: Pitch/Bank

How Cyclic Works

The cyclic affects the angle of individual rotor blades at different points in a 360° revolution. The individual blade angles are increased during half of the revolution, and decreased during the other half. Steeper blade angles generate additional lift during part of the revolution, causing the blades to flap higher. During the rest of the revolution, the blades don't rise as much because the blade angle (and lift) is less steep.



The result of this change is that the entire rotor disc (a circular plane formed by the revolving blades) adopts a new "tilt," or attitude. This effectively changes the direction of thrust, allowing the pilot to gain forward speed, bank and pitch.

You can only tilt the rotor disc so far (in other words, you can't pitch down too steeply). Once the angle of attack (angle at which the blades meet the air) is too great, the blades fail to generate lift. This is called *stalling*.

Directional Control Pedals

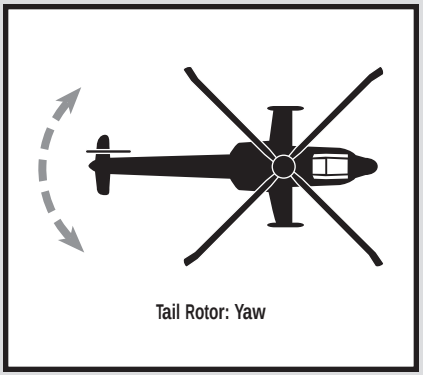
Directional control pedals tail rotor control heading by increasing or decreasing the pitch of the tail rotor blades. You can use pedals or keystrokes to “push” the helicopter’s tail left or right, which yaws the nose in that direction. (This is most effective at low speeds.)

[Yaw the nose left

] Yaw the nose right

How Directional Control Pedals Work

The tail rotor controls the direction in which the nose is pointed. This direction can be different than the flight path of the helicopter. Pilots mostly use the directional control pedals to spin the helicopter during a hover. However, pedals are also used in conjunction with the cyclic stick to make a sharp turn at low speeds. (At high speeds, the pedals don’t do much more than counteract torque produced by the main rotor.)



Tail Rotor: Yaw

The blades on the tail rotor are angled so that when the pedals are centered, the blades produce just enough lift to offset the torque produced by the main rotor (see **Torque**, p. 3.8). When the pilot pushes the pedals to either side, he is changing the pitch of all the tail rotor blades. This is identical to how the collective stick controls the pitch of the main rotor blades.

Applying more force to the right pedal causes the helicopter body to rotate to the right. Applying more force to the left pedal decreases collective and rotates the helicopter to the left.

In-Game Flight Tutorials

Training missions available in the Training Room on the base will guide you through the various helicopter’s features and capabilities. The tutorial missions feature a voice-over interspersed with interactive, hands-on training. For details, see **Training Building**, p. 1.5.

Adjusting Realism and Difficulty

If you selected **CASUAL** settings during installation, the flight settings will be simple. You can set more realistic options in the **Options Menu**. See the *Install Guide* for details.

See **Options Menu** in the *Install Guide* for details on each option.

1. Open the **OPTIONS** menu (press Esc (in-flight) or Alt O (otherwise)).
2. Select **CUSTOM**. The **REALISM** options have let you control enemy skill, co-pilot/gunner involvement and flight dynamics. The FLIGHT MODEL options let you set various flight dynamic options.
3. Press **ACCEPT** until you back out to the main screen.
4. Select **ACCEPT** again to close the option screen.

Autopilot and Coordinated Flight Functions

You can also utilize several in-flight functions to make flying easier.

Autopilot. Automatically steers you to your next waypoint. (You can adjust speed and altitude while autopiloting.)

Hover Hold. Maintains a hover at your current altitude.

Force Trim. Maintains current cyclic position, allowing "hands-off" forward flight.

Autopilot

The game has an autopilot feature that will continue to fly the helicopter without your assistance. This is useful when you're traveling between waypoints and don't want to continually adjust the flight controls. You can adjust altitude and speed while in autopilot mode.

You have several autopilot settings. Press A multiple times to cycle through them.

A (1x) Autopilot on a straight course (AP1 appears in the upper right corner of the IHADSS) In the Black Hawk, this is an indicator light (see **Black Hawk Analog Cockpit**, p. 2.54. The Kiowa displays the current autopilot setting in the VSD.

This takes you on a straight course that follows your current heading at the current altitude and speed settings.

A (2x) Fly toward next waypoint (AP2 appears in the upper right corner of the IHADSS) In the Black Hawk, this is an indicator light (see **Black Hawk Analog Cockpit**, p. 2.54. The Kiowa displays the current autopilot setting in the VSD.

The second time you press the autopilot key, you fly toward your next programmed waypoint.

A (3x) Deactivate autopilot

Autopilot disengages automatically when you press A a third time, or when you move your joystick or adjust collective using normal controls. It will also disengage if you've reached your final waypoint. (At that point, it simply stops flying forward and hovers at a constant altitude.)

If autopilot is active in the Longbow, AP1 or AP2 appears in the top right corner of the IHADSS display. In the Black Hawk, this is an indicator light (see **Black Hawk Analog Cockpit**, p. 2.54. The Kiowa displays the current autopilot setting in the VSD.

Text also appears above the actual airspeed and altitude indicators on the IHADSS. It gives the current autopilot settings for airspeed and altitude. These settings change if you alter the autopilot settings.

Advanced Autopilot Keys

Ctrl ↑ **Increase altitude.** Keep this key combination until you've set the autopilot to the desired altitude. The default altitude is 100 feet above ground level. You can adjust this in 50-foot increments, up to 500 feet.

Ctrl ↓ **Decrease altitude.** Keep pressing this key combination until you've set the autopilot to the desired altitude. You decrease this in 50-foot increments, down to 100 feet.

Ctrl → **Increase forward speed.** Keep pressing this key combination until you've set the autopilot to the desired speed. Whenever you autopilot, you'll travel at this speed. The default speed is 100 knots. You can change this in 10-knot increments, from 60 to 150 knots.

Ctrl ← **Decrease forward speed.** Keep pressing this key combination until you've set the autopilot to the desired speed. Whenever you autopilot, you'll travel at this speed.

Hover Hold

All helicopters tend to drift and rotate during a hover. If you're hovering and need to stay put, activate this auxiliary autopilot function. You must be flying slower than 15 knots (including any sideways velocity, or "side-slip"). With hover hold active, the helicopter assumes the current altitude and attitude.

H Toggle hover hold mode on/off

In the *Longbow*, HOV appears in the upper right corner of the IHADSS. In the Black Hawk, this is an indicator light. See **Black Hawk Analog Cockpit**, p. 2.54. The Kiowa displays hover hold in the VSD. This option deactivates when you move the cyclic stick or adjust collective using normal controls.

You can go into a hover while autopilot is active. Pressing the hover key (H) during autopilot will slow you down and bring you into a stable hover.

Force Trim

If you're using a joystick, you can reset its center point. This allows you to maintain forward flight without keeping the joystick constantly pressed forward. Simply adjust the rotor pitch until you achieve your desired speed and are flying level. Then, activate force trim to "freeze" the cyclic in that position. It will remain in that position until you toggle this option off. (You can still maneuver using your joystick, but whenever you return it to the center position, you'll be flying forward.)

Shift C Toggle cyclic force trim on/off (default is off)

PRACTICE FLIGHT (NON-COMBAT)

This section covers the basics of non-combat flight — how to take off, navigate, hover and land. A keystroke at the beginning of a line indicates which key you should press to perform the listed action. A key in parentheses indicates a keystroke you'll need in the future (but don't need to press now). You can practice flight techniques in the Free Flight training mission. (Left-click on the Training Building in the overhead Base view, then on the Free Flight book. The instructor will explain a few details about autorotation. Don't worry about that – get the basics down first.)

In the following sections, use these controls whenever you're instructed to adjust collective, cyclic or the directional control pedals:

Collective	+ =	Increase collective (and altitude)
	– -	Decrease collective (and altitude)
Cyclic	↑	Pitch the helicopter down (or push joystick forward)
	↓	Pitch the helicopter up (or pull joystick back)
	←, →	Bank the helicopter left, right (or push joystick left, right)
Pedals	[	Yaw nose left
	]	Yaw nose right

Startup

To interpret cockpit items, see Integrated Helmet and Display Sight System, p. 2.12, and Multi-Function Displays, p. 2.24.

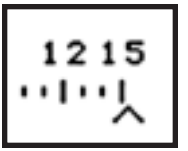
Selecting the Instant Action tower places you in the cockpit of an AH-64D Longbow Apache. The following steps will teach you how to perform basic maneuvers and help familiarize you with the cockpit.

Note: *The following step, disengaging the rotor brake, is not necessary for Instant Action Missions. It is listed here because you'll need to do this in all other mission types.*

(R) **Make sure rotor brakes are disengaged.** Usually, before you can take off, you need to disengage the rotor brake. In Instant Action, however, you begin the mission in a hover.

Once the brake is released, the blades will reach idling speed. You can see the rotor RPM increasing in the Engine MFD page when it reaches 100, you're ready to go.

Shift 1 **Activate NAV Master Mode.** Activate the Navigational master mode and check the location of your first programmed waypoint. (Note that you are in Cruise IHADSS mode.) The current waypoint appears as a carat on your scrolling heading tape.



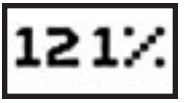
Note that when you changed master modes, the information in the two small display (MFD) screens changed as well. In the current right MFD (Tactical Situation Display), the next waypoint (when it's in radar range) appears as a circle with "2" next to it.

<, >. **Cycle through MFDs.** The AH-64D Longbow has nine MFD "pages" of information that can be displayed in either MFD window. You can change the information that appears in this screen. <. operates the left MFD; >. operates the right MFD. (You can also use Shift <. and Shift >.)

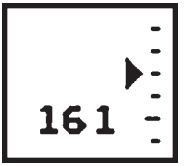
For now, cycle back to the Tactical Situation Display (TSD) MFD. These displays won't really be important until you start flying combat missions.

Takeoff

[+=] **Increase collective.** You need to increase rotor speed by adding collective until the helicopter starts to rise. (The more collective you add, the more torque is produced. To see the percentage of torque, look at the reading in the upper left corner of the IHADSS display. Be careful not to exceed 100% torque — if you do, the rotor may become overloaded.)



[+=] **Climb.** As you continue to add collective, you progressively tilt the angle of each rotor blade. As the blades push against the air and create lift, the helicopter rises.



[+=], [-] **Stabilize altitude**. Watch the radar altitude tape on the right side of the IHADSS display. Once you've risen to roughly 150 feet, reduce collective until you can maintain a constant altitude. When this happens, you're in a hover.

[Shift][+=] / [Shift][-] These keys provide fine collective control (±1%)

[H] **Activate Hover Hold**. When you activate this toggle, the helicopter automatically trims its controls to maintain a hover. In the Longbow, HOV displays in the top right corner of the IHADSS. The Black Hawk has an indicator light that glows, and the Kiowa VSD.

[[], []] **Adjust heading.** Swing the tail rotor around and center the waypoint carat in the middle of the compass at the top of the IHADSS. When it's correctly positioned, your helo's nose is oriented toward waypoint 2.

In-Flight

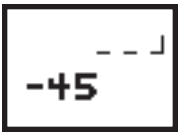
↑ **Move cyclic forward.** To deactivate hover hold, use the cyclic. You can now gain forward speed by using the cyclic to tilt the rotor forward.

As you gently push the cyclic stick forward, the nose of the helicopter drops slightly. Don't apply cyclic too quickly — the helicopter's controls take a moment to produce tangible movements, making it easy to overcontrol.

+=, ↑ **Climb to cruise altitude**. Unless you're extremely close to an enemy position, you'll want to gain some altitude and cruise toward the first programmed waypoint. Increase the collective and push the cyclic slightly forward to both accelerate and gain altitude.

↑ **Increase cyclic**. Keep nudging the cyclic forward, to pitch to an angle of about 45°. (Check the angle by looking at the pitch ladder indicator.) Once you have this angle, keep increasing collective until your airspeed indicator reads 120 knots.

+=, -_ **Steady altitude.** Keep an eye on your radar altimeter. Once you've reached cruising altitude (around 200 feet), reduce collective slightly until altitude remains constant. You can also use slight cyclic adjustments.



←, → **Turn.** To adjust your heading, gently move the cyclic left or right. The Longbow Apache has an electronic system that compensates for sideslip by adjusting throttle and control inputs — this is called a coordinated turn.

In gradual turns (at speeds above 60 knots), use the cyclic instead of the directional control pedals. The pedals are reserved for low-speed turns or quick-turn combat maneuvers, but they aren't that effective in fast, forward flight.

Note: *If you've turned off* COORDINATED TURNS *(by pressing* Shift D*), you'll need to compensate for sideslip by adjusting the tail rotor with the pedals. (During low-speed turns, the* COORDINATED TURN *option has no effect.)*

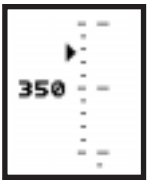
Landing

Once you've visited all your waypoints, perform the following steps to transition into a hover and land.

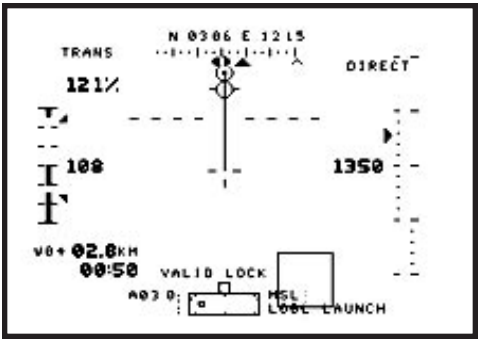
Note: *You can make landings easier by activating the* **IN-FLIGHT OPTIONS** *menu and selecting* EASY LANDINGS *or* NO CRASHES. *(See* Install Guide *for details.)*

[↓] **Reduce forward velocity.** When you're within a mile or so of the LZ, ease back on the cyclic to reduce your speed to approximately 70 knots. At the same time, reduce the collective to shave off altitude.

You'll need to be about 50 feet above the ground when you begin your hover, so watch the radar altimeter tape closely during your approach.



[Shift][7] **Switch to Transition IHADSS mode.** This mode is useful when you're getting ready to land. With this mode active, your IHADSS display looks like it did at takeoff.



[←], [→]
[↑], [↓], **Approach the LZ.** As you close in on the landing zone, adjust your heading using the cyclic control and align the nose of the helicopter with the LZ.

[↓] **Slow to hover speed.** At about 1 kilometer away from the LZ, pay attention to the altimeter. You need to reach an altitude of 50 feet. When you've done so, decrease the cyclic to reduce your forward speed to 15 knots.

[↓] **Transition into a hover.** When you're directly over the LZ, adjust cyclic until you stop moving. Don't forget to turn off force trim if it's active (press [Shift][C]).

[-] **Decrease collective.** Once you cease moving forward, the craft starts to rise. To correct this, reduce your collective until you maintain a constant altitude.

[ ], [ ] **Maintain heading**. You should be correctly aligned at this point. However, wind or other adverse conditions may require you to make slight heading adjustments. Steer using the pedals, not the cyclic. (Remember, the directional control pedals are used to turn at low speeds.)

[-] **Descend and touch down.** When your heading is correct and steady, reduce the collective enough to descend to a few feet above the ground, then *gently* ease up to drop the final few feet. You want to make as soft a landing as possible to avoid damaging the landing gear.

[B] **Apply wheel brakes.** Your helicopter may drift after you touch down. Applying the wheel brakes ensures that you stay in one place.

[R] **Engage rotor brake.** After you touch down, engage the rotor brake to stop rotor spin.

Advanced Combat Landing

Sometimes, your airbase may be under attack or the designated LZ may lie perilously close to enemy forces. In this case, you may not have time to follow usual landing procedures and may have to switch to an advanced landing tactic.

[↑], [↓], **Make a low-flying approach.** Try flying as close to the ground as possible

[←], [→] during your approach. Then, fly over the LZ at nearly full speed (ideally, 50-70 knots).

[~], [↓] **Fly over LZ and lose speed.** After you pass directly over the zone, zero out collective and pull back sharply on the cyclic. This yanks the helicopter's nose up and causes the craft to snap backward.

[-] **Reverse and settle.** At this point, you'll have passed forward over the landing area. The cyclic adjustment, however, reverses your direction and re-centers you over the pad. Once this happens, reduce your collective and settle onto the LZ as gently (but quickly) as possible.

Autorotational Landing

Note: *One of the tutorial missions* (FREE FLIGHT) *explains how to perform an autorotational landing. See* **Training Building**, *p.1.5, for details.*

In the case of engine failure, landing safely becomes a dangerous process. Fortunately, helicopters are able to *autorotate*, or use the blade surfaces as "wings" to glide in for a survivable landing.

As long the helicopter has forward speed (around 60 knots), you can land it with minimal damage and injury. An autorotational landing is somewhat similar to gliding in an airplane — the speed of air moving over the blades creates lift sufficient to support the weight of the helicopter.

During development, helicopter pilots rigorously test the speed limits of a prototype model. They purposely cause blade stall to determine the safest operating speeds. The data collected by these pilots is used to generate height-velocity curves. These charts dictate how much airspeed and altitude a pilot must have to make a safe autorotational landing if the engines fail. An autorotational chart with safe airspeeds and altitudes for autorotational landings is given in **Autorotational Descent Charts**, p. D.4.

Follow these steps to make an autorotational landing:

- **Reduce collective.** When engines fail, your first reaction must be to lower the collective to its minimum setting (0%). This causes the blades' angle of attack to decrease, which reduces air resistance against the blades and retains the current RPM setting.
- **Dive for speed.** If airspeed drops below 60, your rate of descent will surpass 40 feet per second, which is the maximum descent rate for survival of the craft and crew. As much as altitude permits, dive to increase your forward airspeed.
- **Choose a makeshift landing site.** Start scanning ahead for a suitable landing site. Anyplace flat and away from enemy fire will work, as long as you can keep your airspeed constant. Adjust your heading so that the nose of the craft is pointed toward the crash site.
- **Decrease forward speed.** Once you approach the landing site, pull back on the cyclic stick to reduce your forward speed.
- **Add collective.** This slows your descent when your altitude nears 100 feet. This angles the blades and provides lift to cushion against the crash.

  Applying collective too early causes the craft to hover above the ground and drop vertically as the rotor blades lose speed and quit providing lift. Adding cyclic too late doesn't bleed off enough vertical speed and causes a high-speed landing. Either way, the hard landing becomes extremely dangerous and the rate of survivability drops drastically.

5
Combat

5. COMBAT

The mobility of rotary craft has radically changed military strategy — not only can helicopters transport troops and arms into critical areas without airstrips, but they can also cross any type of terrain at low altitude. They have a maneuverability advantage over faster fixed-wing fighters in that they can fly close to the earth and shift from forward flight into a hover at a moment's notice. Their only limiting factor is their top speed.

The advent of advanced weapons systems and laser-guided/radar-active missiles has also helped transform the helicopter from a lumbering, lightly-defended transport to a formidable battlefield weapon. The arrival of such modern gunships has already changed the helicopter's role in combat. Previously limited to attacking lightly armed enemy positions, attack helicopters can now engage any target, including submarines, ships, tanks, ground troops, urban facilities, portable AA guns and most fighters. They can also provide target information to nearby air and ground units. Unfortunately, SAMs, AAA and man-portable air defenses continue to modernize as well, remaining a major threat for helicopter pilots engaged in combat.

STAYING ALIVE

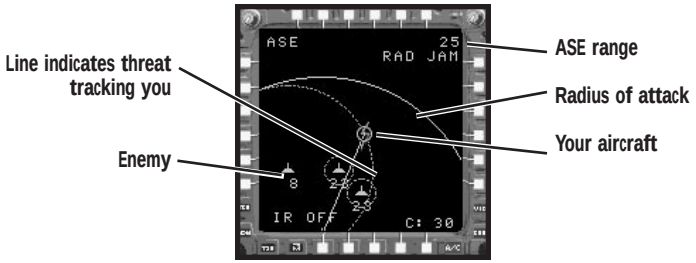
Today's helicopters face increasingly dangerous ground and air threats — weapons that target by remote laser, missiles that employ active and semi-active radar-homing, and more sensitive, all-aspect IR (infrared, or heat-seeking) missiles. Several Longbow Apache features counteract these threats. A longer, leaner profile with minimized vertical surfaces presents a smaller radar target. The Black Hole IR suppression system diffuses hot engine exhaust gas through ejector nozzles to lower gas plume and metal temperatures, making the Longbow Apache a poorer IR target. The Black Hawk and Kiowa also both have a full suite of defensive countermeasures, and the Kiowa (with its small size, maneuverability and recon design emphasis) is a particularly slippery target.

However, these advances in design cannot completely protect an aircraft, and its pilot must accurately understand all ASE (Aircraft Survivability Equipment) systems in order to locate and identify, then avoid or eradicate all threats and survive the mission.

Aircraft Survivability Equipment

Longbow

Most ASE is automated. When a threat engages you while flying a Longbow, the ASE page automatically pops up on the left MFD. (It remains up until you switch to another left MFD page.) Threats are represented by various symbols — 23 is a ZSU-23 anti-aircraft gun, for example. (For detailed information on the symbols used in this window, see **Aircraft Survivability Equipment MFD**, p. 2.35.) The ASE page only displays objects that are actively using their radar.



The rings around the symbols show the radius of attack for each ground threat. When you are inside this range, you can be hit. If the ring around a threat turns solid, the threat has switched from search mode into tracking mode. If a line connects you to the threat, then the threat is actively tracking *you*.

At this point, your jammer will automatically kick in — you will know this by the lightning bolt that appears over your aircraft on the ASE MFD and by looking at the jammer indicators. RADAR JAM appears for radar threats; IR JAM appears for IR threats. The AN/APR 39A Radar Warning Receiver (RWR) also has a voice capability that will verbally warn you when threats are tracking you.

You can, at any time, manually control your ASE.

I	Manually toggle IR jammer on/off
J	Manually toggle radar jammer on/off
Delete	Increase/decrease ASE range
Shift A	Toggle ASE autopage on/off

When the ASE autopage feature is off, the ASE page will not pop up automatically when you are engaged. Turning autopage off does not turn off the voice warning system.

Evading Missiles

Longbow, Black Hawk, Kiowa

SAM sites can be more dangerous than conventional guns because the missiles they fire at you are infrared, radar-active or laser-guided. (If the REALISTIC ASE option is active, only radar-guided missiles will appear on the ASE page.) When a SAM threat symbol on the ASE page begins to flash, the threat is launching. Your RWR begins to track the missile's progress (you can see the missile's track on the ASE MFD) and your jammers fire up. Your chaff dispenser automatically ejects a cloud of radar-reflective aluminum strips behind the aircraft.

Both the Black Hawk and the Kiowa have chaff pods capable of loading both chaff and flares (Longbows load chaff only). Flares are effective against heat-seeking threats. Although the Black Hawk does not have an ASE display, it does have its RWR indicator (see p. 2.54) to warn of incoming missile threats.

If ASE alone isn't spoofing the missile, you'll have to dodge it. Depending on your situation, there are a couple of ways to do this.

- Turn until you are facing the missile.
- When the missile is a few seconds away, drop down to the ground and remain still.
- If for some reason you can't drop down to the ground, try slipping to the side when the missile is a few seconds away.

By dropping down to the ground, you either put something between you and the missile or get lost in the ground clutter. You also leave a cloud of chaff in the air. All of this will probably cause the missile to lose its lock on you. (This defensive tactic doesn't work against **RAPIERS**, however.)

As with other ASE functions, you can manually dispense chaff at any time.

C	Dispense chaff

DAMAGE

Longbow, Black Hawk, Kiowa

- Systems can be damaged on your helicopter. However, all three helicopters have damage control options (such as a fire extinguisher). If one or both engines catch fire, you can manually extinguish the blaze from the cockpit. (The extinguisher works on either engine in the Longbow). You can only activate a fire extinguisher once per mission.

  Ctrl F — Activate fire extinguisher (fire bottle)

- If one of your engines has been severely damaged, you can shut it down using Ctrl [(shut down left engine) and Ctrl] (shut down right engine). (The Kiowa has only one engine — use Ctrl [for it.)

- The UPFRONT display shows additional damage information that doesn't display in the System MFD.

IHADSS FAIL — (Longbow only) **Integrated Helmet and Display Sight System Failure.** IHADSS is damaged/destroyed and no longer displays.

FCR FAIL — (Longbow only) **Fire Control Radar Failure.** Fire-Control Radar is damaged/destroyed and can no longer detect new targets or guide Radar Hellfires.

LASER FAIL — (Longbow, Kiowa) **Laser Spot Tracker/Designator Failure.** Laser optics are damaged/destroyed and are no longer able to lase targets or guide laser Hellfires.

TADS FAIL — **Target Acquisition and Designation System Failure.** TADS optics are damaged/destroyed, and TADS camera no longer pans.

PNVS FAIL — **Night Vision System Failure.** Night vision optics are damaged/destroyed, and you can no longer use PNVS.

FLIR FAIL — **Forward Looking Infrared System Failure.** FLIR optics are damaged/destroyed, and you no longer receive FLIR images.

RJAM FAIL — **Radar Jammer Failure.** Radar jammer is damaged/destroyed and can no longer jam radar guided missiles.

PWR FAIL — (Longbow, Kiowa) **Radar Warning Receiver Failure.** RWR is damaged/destroyed, and the ASE MFD no longer appears. Chaff and jammer systems do not automatically engage threats. A failure message sounds.

SCAS FAIL	**Stability Control Augmentation System Failure.** Digital flight control system is damaged/destroyed. You cannot auto-hover or autopilot, and the helicopter's flight characteristics suffer.
APU FAIL	**Auxiliary Power Unit Failure.** APU is damaged/destroyed, and you cannot restart the engines if they are shut down. "APU is on fire" message sounds.
BUCS FAIL	**Back-Up Control System Failure.** Back-Up Control System is damaged/destroyed. "BUCS has failed" message sounds. The hydraulic system must remain functional for the BUCS to operate. If both the SCAS and BUCS are damaged, then the aircraft is no longer controllable.
OIL PSI LO	**Oil Pressure Low.** Oil line is leaking/destroyed. Engine temperature increases and the chance of fire increases.
FUEL PSI LO	**Fuel Pressure Low.** Fuel line is leaking/destroyed. Fuel consumption increases, and if your helicopter is on fire, it will probably spread.
HYD PSI LO	**Hydraulic Pressure Low.** Hydraulic lines are damaged/destroyed. Hydraulic pressure drops, and control response deteriorates.

TACTICAL MISSIONS

Each of the three helicopters modeled in *Longbow 2* fills a significant and unique battlefield function. Since you're the one who will be deciding which aircraft to send on a given mission (see **Mission Planning**, p. 1.11), it is necessary to understand the functional differences between the aircraft in your arsenal.

The Longbow is an AH — Attack Helicopter. The Kiowa is an OH — Observation Helicopter, and the Black Hawk is a UH — Utility Helicopter.

AH-64D Longbow Apache

Although the Longbow Apache is one of the most complicated and sophisticated pieces of high-tech hardware, its mission is simple. It is a killing machine. It packs as much destructive potential as possible onto the smallest, most agile platform possible and then make the whole package as smart and versatile as possible. There's very little on the modern battlefield that doesn't fear the Longbow Apache.

The most common wartime mission for the Longbow Apache is to move in and annihilate the enemy. Its primary functions are search-and-destroy and tactical strike. The Longbow's particular specialty and original reason for existence is as a tank destroyer, but its capabilities go far beyond that narrow function. Its pop-up and stealth capabilities make it perhaps the most deadly ambush machine designed to date. As an escort, it's unsurpassed — a Black Hawk guarded by a pair of Longbows is about as safe as it gets.

Its advanced imaging, targeting and communications capabilities give the Longbow Apache formidable recon and command/control potential, but despite these abilities, both these functions are properly the function of the Kiowa, which performs them even better. You don't want to use an Longbow Apache as a scout or a command chopper when a Kiowa's available, any more than you want to send a Kiowa out on a solo combat mission when an Longbow Apache's available.

Apache vs. Longbow Apache. Until recently, the AH-64D was a Longbow Apache with the Longbow radar dome. Non-Longbows were AH-64As (the AH-64B prototype never made it to mass production, and only a few AH-64Cs were made). Recently, the Army scrapped its plans to eventually mount Longbow domes on all AH-64 aircraft, while at the same time making significant upgrades to the AH-64As. The net result is that all AH-64 aircraft are considered AH-64Ds, whether they include the Longbow hardware or not.

For the capabilities of the Longbow radar, see **Target Acquisition Modes**, p. 5.10.

OH-58D Kiowa Warrior

The OH-58D Kiowa Warrior is strictly a scout/recon helicopter — a totally unarmed, peek-and-run spy aircraft. The Kiowa *Warrior,* however, adds a light but effective offensive package to the mix, making it remarkably versatile.

As a recon helicopter, the Kiowa has imaging and communications capabilities that are, in many ways, superior to the Longbow Apache's. In particular, its Mast-Mounted Sight (MMS), located high up near the rotors, allows it to peek up over treelines and ridge lines to check out the enemy in exhaustive detail while remaining unseen.

When it's performing its primary function as a spy, many pilots prefer to not even take the Warrior's full weapons loadout. Loading just one of the Warrior's two hard points gives the Kiowa enough offensive punch to blast past an inconvenient threat on the way out of danger, while the decrease in weight from the partial load-out gives it a tiny but potentially crucial edge in maneuverability.

A fully armed Kiowa Warrior, however, is a significant battlefield threat in its own right. It may not come close to the Apache's muscle on a one-to-one basis, but in even small groups the Kiowa Warrior is not to be taken lightly. Three or four Kiowa Warriors make an excellent light strike force, while a pair of Warriors make an excellent escort for a Black Hawk (in a pinch, even one Kiowa Warrior is far better than no escort at all).

The Apache and the Kiowa Warrior together form an ideal combat alliance. In multi-player games, for a devastating strike force against large concentrations of the enemy, try sending a pair of Apaches up the middle while a set of Kiowas harass the flanks. One Apache and one Kiowa also make an ideal combination on search and destroy missions, with the Kiowa providing the search and the Longbow the destroy. The Kiowa can act as a forward observer for the Apache — acquiring targets before the Longbow radar can and feeding them to the Apache for appropriate action.

Finally, if a bit less glamorously, the Kiowa's formidable smarts and inconspicuous size make an ideal command/control platform. In any large strike force of mixed helicopters, the highest-ranking person in the air will probably be in a Kiowa, using its imaging capabilities to keep an eye on the situation and its communications gear to keep the rest of the force on track. The Army even has specialized Kiowas (not modeled in *Longbow 2*) equipped with extra gear specifically for Brigade-level command functions.

UH-60L Black Hawk

The Black Hawk is an airborne utility truck, the spiritual descendent of the faithful Army mule. Black Hawks do not do tricks. The Black Hawk exists to fly straight into hell, take on or put off its cargo, and fly right back out again with maximum efficiency. While the Apache and Kiowa can sit back behind a ridgeline, pop up and unload at their leisure, then high-tail it home when their ammo runs out, the Black Hawk has to be ready to go all the way down the enemy's throat. It takes a special kind of *cojones* to be a Black Hawk pilot. Not only does it lack the smarts and subtlety of a Longbow Apache or Kiowa Warrior, it's also significantly bigger, making a proportionally more inviting target.

The Black Hawk carries a crew of three, and has space for 11 more (one infantry squad) or their equivalent in cargo. Next to troop insertion and extraction, the Black Hawk's other main function is medevac rescue missions.

The Black Hawk's door guns exist for the purpose of suppression — to clear an LZ while the Black Hawk is landing and keep the enemy at arm's length while it takes off. This doesn't mean, however, that the door-guns cannot be or are not used in the air. If the enemy is considerate enough to put himself in the doorgun's sights, it would be rude not to take the shot offered. Black Hawks survive in battle by using every edge they can find.

WEAPONS SYSTEMS

In order to successfully carry out missions, you must accurately find, engage and destroy targets. To do this, you have to know how to use your sensor and weapons systems (described in this section).

Finding the Enemy

If you want to destroy them, you've got to know where they are ....

Visual Tracking

Longbow, Black Hawk, Kiowa

In all helicopters, you can use the F4 virtual cockpit to get a visual on your targets. In the Longbow, your sensor and targeting systems will follow the movement of your "head" and your cannon will even aim itself at the point where you are looking. You can "turn your head" to look at targets by switching to helmet view and cycling through targets. Your helmet view, targeting systems and cannon will automatically lock to the target you select.

F4	Switch to virtual cockpit view
F4 x 2	Slew to current target
F1	Return to front cockpit view

You can also pan your view manually and lock your targeting systems on what you see:

Numpad 8, 2, 4, 6	Pan view (also Alt and joystick)
Numpad 5	Center view
L	Add target to TADS target list and lock onto that target

Using your eyes and cannon this way is the easiest way to locate and engage close threats. To systematically find and engage long-range targets, you should make use of both your co-pilot/gunner and the Longbow and Kiowa's advanced sensor systems.

Sensor Systems

Longbow, Kiowa

AH-64D Longbow Apache without radar. In the Longbow, the TADS sensor package is used to locate and acquire targets. This sensor package has a range of 6km and can pan horizontally 220°, up 30° and down 60°. Contact information is displayed on the TSD MFD. Targets can be viewed on the TADS MFD. Also, the Longbow's laser sensor can be used in conjunction with TADS targeting. See **Laser Operation**, p. 5.22, for details.

AH-64D Longbow Apache. The Longbow Apache features another sensor system, the Westinghouse Millimeter-Wave Fire Control Radar. It has a 360° air mode and a 90° ground mode; raw data for both modes can be displayed on the Radar MFD. Additionally, the FCR can "memorize" contacts — you can bob-up to acquire contacts and then return to cover in order to view this data. Stored radar data is displayed on the TSD MFD. The FCR has a 50km range and illuminates targets for radar-active Hellfires.

Page Up	Switch between Air and Ground radar modes
Page Down	Cycle through TSD ranges
<, >.	Cycle through left and right MFDs

See **Radar MFD**, p. 2.29; **TADS MFD**, p. 2.32 and **Tactical Situation Display MFD**, p. 2.24.

OH-58D Kiowa Warrior. The Kiowa's Mast Mounted Sight (MMS) is ideal for both combat targeting and (the Kiowa's main function) scouting. Located at the top of the rotor mast, it gives the Kiowa the ability to recon while hovering beneath a treeline or ridge line. It has a radius of 190° right or left (giving it an effective coverage of 360°, though it doesn't have the capability for full 360° panning) and 30° of coverage up or down. Functionally, it performs most of the same tasks as the Longbow's TADS, and like the TADS uses an active laser for targeting. Data from the MMS is displayed on the Kiowa's MMS and TSD displays.

See **MMS MFD**, p. 2.43, and **Pilot's Display Unit**, p. 2.48.

Target Acquisition Modes

Longbow

The AH-64D Longbow Apache employs two target acquisition modes: TADS and FCR. Only TADS is available in Longbow Apaches without radar.

Home	Toggle between TADS/FCR acquisition modes

TADS or FCR in the bottom left corner of your IHADSS (in the left side of the High Action display) tells you which target acquisition mode is active. The target acquisition mode determines what kind of target list is generated. You use the target lists to select and engage targets.

See **Realistic FCR Operation Commands** (p. 2.31) and **Realistic TADS Operation** (p. 2.33) for more information on acquiring and locking targets.

TADS / MMS Target Acquisition Mode

Longbow, Kiowa

In this mode, your CP/G (Co-Pilot/Gunner) provides you with a target list. The TADS/CPG list can prioritize targets — taking into account distance, angle, weapon constraints, threat perception, etc. — and distinguishes between friendly and enemy targets. The list does not "remember" targets — once a target is out of Line Of Sight (LOS), Field Of View (FOV) or range, it is removed from the list.

With TADS as the active mode, you can employ laser targeting. See **Laser Operation**, p. 5.22, for details.

FCR Target Acquisition Mode

Longbow

The Fire Control Radar in the dome on top of the chopper's mast provides you with a list of targets. This list is not sorted, and *there is no visual distinction between friendly and enemy forces on the TSD*. Targets remain on the list even if they leave LOS or FOV — they are removed from the list only if they go out of range while the FCR is tracking them. The sweep rate of the FCR dome determines how quickly new targets are detected and added to the list – see **Radar MFD** (p. 2.29) for details.

Priority Fire Zones (PFZs)

Longbow, Kiowa, Black Hawk

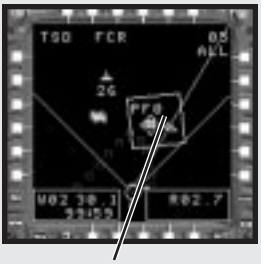
You can give your wingman and backup lists of targets to attack by creating a PFZ and handing them off. (See **Giving Your Wingman Targets**, p. 5.24, and **Calling on Backup**, p. 5.26.) Creating and handing off PFZs is an important tactical skill.

In the Longbow Apache this is a sub-mode of the FCR that allows you to select and fire on multiple targets.

You can create a PFZ in any of the three helicopter types. The Longbow with radar, however, is the only one that allows you to fire multiple targets at once.

Creating a PFZ. Position the mouse cursor over the TSD. Right-click-and-drag a box around the group of targets that you want to include in the zone.

🖱	Right-click-and-drag to create PFZ
Shift 🖱	Add targets to your PFZ



Priority Fire Zone

A PFZ list includes only the targets that are in the PFZ box *when the box is created* — any targets which subsequently appear in the PFZ box on the TSD will not automatically be added to the PFZ target list. The list can also contain a maximum of 16 targets. To manually add targets to a PFZ, hold down Shift and left-click on the targets on the TSD to be added. *A PFZ target list can include friendly and enemy targets, and no distinction is made between them.*

Selecting a PFZ. Left-click on the PFZ label (PFZ 1, PFZ 2, etc.) or cycle through the PFZs with Q and Shift Q. Selecting a PFZ activates the target list for that PFZ: when you call for a target, it will come from this active list.

Left-click on label to select PFZ	Q Select next PFZ
	Shift Q Select previous PFZ

If you have a PFZ active, it remains active, even if it is no longer visible on the TSD, until you select another PFZ or use your cursor to select a single target. (The TSD displays target information for targets in a 90° arc in front of you only.) The targets you call for will come from this list, even though you cannot see them. To delete the PFZ, you have to bring it back into view or press Shift D

Deleting a PFZ. You can delete PFZs at any time, whether you've cleared them out or not.

Left-click-and-hold, then right-click on PFZ label	Shift D Delete selected PFZ
	Ctrl D Delete all PFZs

When your PFZ is empty, it will *not* automatically be deleted. You must manually delete the PFZ before you can call for targets from the FCR target list. (You can select or create another PFZ and delete the empty one later, however.)

Selecting Targets from Your Target List

Longbow

The following key commands select objects from your *current target list*. Thus, if you are in TADS target acquisition mode, the targets are selected from the TADS/CPG list. If you are in FCR target acquisition mode, targets come from the FCR target list, *unless* you have a PFZ selected on the TSD. If you have a PFZ selected, targets come from the PFZ list.

The commands behave differently depending on which list is active, because the TADS/CPG list is sorted by priority and friendly/enemy status. The FCR target list is sorted by the order contacts were acquired. PFZ lists are not sorted at all.

T	Target next enemy on list (next *object* on PFZ list)
Shift T	Target previous enemy on list (previous *object* on PFZ list)
Y	Target next friendly on list (non-functional on PFZ lists)
Shift Y	Target previous friendly on list (non-functional on PFZ lists)

When you select a target, a dotted cross appears over it on your IHADSS.

Getting Best Cannon Targets

Have your CP/G sort targets according to your distance to target, with closest targets first. This command is available with the TADS and FCR lists. After your list is re-sorted, use the keys above to cycle through targets.

Ctrl T	Prioritize your TADS or FCR list, putting closest targets first

Getting Best Missile Targets

When in TADS target acquisition mode, you can ask your CP/G to sort targets in order of "best" *missile* target. Your CP/G decides which is "best" based on range to target, aspect angle, threat perception, etc. This command is not available with FCR and PFZ lists. After your list is re-sorted, cycle through your targets with the above target keys.

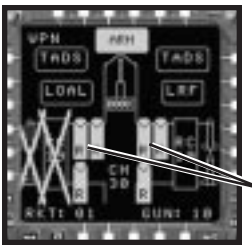
Alt T Prioritize your TADS list, putting "best" targets first

Selecting Targets with the Mouse

When in FCR target acquisition mode, you can also select a target from the TSD by clicking on it with the mouse.

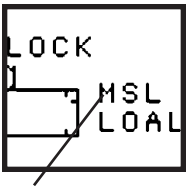
Engaging Targets with Cannon, FFARs and Stingers

Longbow, Kiowa



Active weapon

Longbow. The Weapons MFD displays your loadout and number remaining for weapons, chaff and cannon rounds. The active weapon is highlighted (see **Weapons MFD**, p. 2.33). The VSD MFD performs the same function in the Kiowa (see **VSD MFD**, p. 2.41).



Current weapon

The current weapon also appears in the bottom right corner of the IHADSS. RKT stands for FFARs, MPSM for M-261 rockets, ATA for Stingers and MSL for Hellfires. (Your cannon is always active in addition to your current weapon.)

Kiowa Warrior. The Pilot's Display Unit (PDU) shows targeting and current weapon information. The active weapon appears as an icon in the display — see p. 2.48 for details. The Virtual Situation Display also gives weapon information (shown here).

Which weapon you use should depend on your loadout, the type of target and how close you are to it.

Backspace Cycle through weapons

VSD MFD

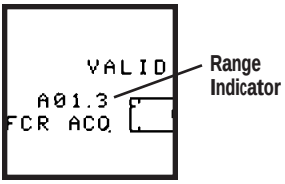
M230 Chain Gun Cannon

Longbow

Your cannon is useful against "soft" targets, such as infantry and unarmored trucks. It has an effective range of less than 1km (although you can still destroy things up to about 3km, provided you shoot at them long enough). If you have a target selected, the gun is automatically aimed so that the calculated impact point coincides with the target's anticipated movement. If no target is selected, the cannon will fire straight ahead, or in the direction the pilot's helmet is oriented, if you are in Virtual Cockpit (helmet) view — F4. (Pressing F4 once enters this view. Pressing it a second time locks onto the current target and slews the view to track the target's movement.)

To engage TADS/CPG target with the cannon:

1. Select a target and keep it onscreen.
2. If REALISTIC TADS OPERATION is on, the laser should also be on to add accuracy to the cannon.
3. Wait until the range indicator reading on your IHADSS display is less than 1km.
4. Fire until the target is destroyed (Enter).



If you move or pan your TADS camera, your cannon and TADS unlock from your current target. You must relock your gun to your current target in order to fire at it.

Shift L Relock TADS and cannon on your current target

Global Helicopter Technology CFD-5000 Pod

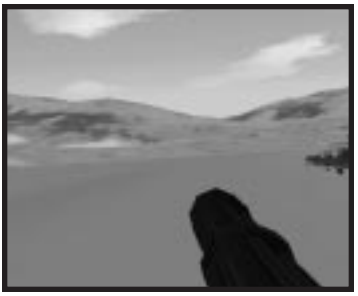
Kiowa

The Kiowa has a Global Helicopter Technology CFD-5000 pod that houses a an M2 .50-caliber Heavy Barrel Machine Gun. In the game, the Kiowa can mount one of these guns at a time (missiles and rockets can be loaded normally on the other hard point). The browning is probably the best choice only in situations where you expect massed forces of infantry and unarmored targets. The browning is a fixed-forward weapon, aimed by orienting the helicopter itself towards the target. A simple crosshair sight in the middle of the windscreen is provided to assist in targeting, and the gun's accuracy can also be gauged by its tracer trail.

Black Hawk Door Guns

Black Hawk

The UH-60L Black Hawks modeled in *Longbow 2* do not have any cockpit-controlled armament, but they do have a pair of pintle-mounted door-guns, one on each side of the aircraft. The primary purpose of these guns is to clear a landing zone and provide covering fire while taking on or putting off cargo or passengers. However, they can also be used for in-flight aircraft defense, or even close air support against infantry and unarmed targets.



The type of door gun to be mounted can be selected during Mission Planning, but both guns on any given helicopter must be of the same type. The M134 5.56 mm mini-gun possesses a rate of fire of several thousand rounds per second, and is unmatched against infantry and unarmored targets. However, the superior penetration of the M60D 7.62mm machine gun, even with a rate of fire barely 10% of the M134's, makes it the gun of choice against lightly armored targets, and some pilots may prefer it against other helicopters as well.

You can toggle back and forth between the Black Hawk cockpit and the door gun position by using numpad [0]. Numpad [.] switches between the left and right door guns. Like the Longbow's cannon, a door gun is aimed by using the numpad keys. This is not because the door guns possess any fancy computerized helmet-sighting systems — it's simply assumed that if a door gunner is looking at something, he's also aiming at it. To move from one door gun to another, use the numpad [.].

Numpad [0]	Switch from cockpit to door gun position
Numpad [.]	Switch between left/right door gunner position
Numpad [2], [8] [4], [6]	Aim door gun
or [Alt] + Joystick	

Stinger Infrared-Guided Missile (AIM-92)

Longbow, Kiowa

Stingers are fired against air targets, using an IR seeker head to track the target's heat source. When the seeker locks on to its target, it emits a shrill tone, signaling you to fire. A Stinger's range is about 4.5km, and it is extremely fast.

To engage an air target with Stingers:

Longbow

1. Switch to ATA master mode with Shift 4.
2. Select a target.

   In the Longbow, a bouncing "donut" representing the missile's seeker head appears on the IHADSS.

   In the Kiowa, a circle appears in the PDU and VSD.

Kiowa VSD

3. Orient your aircraft toward the target.

   In the Longbow, the seeker will home in on the target, and the "donut" will stop moving.

   In the Kiowa, you must move until the target is positioned directly under the circle in the PDU.

4. When the circle turns from dashed to solid, fire (Spacebar).

In the Longbow, messages in the Weapon Inhibit Field can help guide you in getting a valid lock. See **Weapon Inhibit Field**, p. 5.20.

In the Kiowa, Stingers are aimed using the PDU display (or the VSD MFD, which function similarly). When a Stinger is your active weapon, the PDU displays a circular targeting area. If the enemy is located anywhere within that area, he is targeted and should be hit by fired Stingers. See **Kiowa Weapon Constraints**, p. 2. 49, for details on acquiring locks and firing weapons in this helicopter.

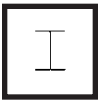
Folding Fin Aerial Rocket (FFAR)

Longbow, Kiowa

FFARs can be used against lightly armored targets, such as troops, trucks and support vehicles. These rockets are *unguided*; you must aim them directly at the target to fire. You have two types to choose from — HE rockets (designated as RC in the Weapons MFD) or multiple-projectile submunition rockets (designated as MPSM).

Line the I-beam up with the cross hairs over your target. (The I-beam must be centered horizontally and vertically, but the rocket pods will track up and down the extent of its vertical bar.)

You can fire FFARs in salvos of 1, 2, 4, 8, 12 and 24 — [S] cycles through the salvo sizes. (You can only see this if you have the Weapon MFD active — the number following RKT at the bottom of the Weapons MFD indicates your current salvo size). The 24 rocket salvo is unavailable to the Kiowa, since it can't mount more than two 7-rocket pods.



Longbow

To engage a TADS/CPG target with FFARs:

1. Use [S] to set number of rockets per salvo, then select a target.
2. Cycle through weapons ([Backspace]) until rockets are selected.

   In the Longbow, RKT appears in the bottom right corner of the IHADSS.

   In the Kiowa, the rocket crosshairs appear in the VSD MFD.

Kiowa VSD

3. Line up the I-beam so that it is over the target box.

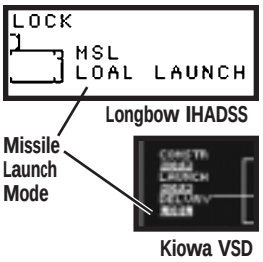
   In the Kiowa, the I-beam aligns you with the target horizontally — you must also manuever so that the vertical constraint (the circle) is over the target as well.

4. Fire ([Spacebar]) when the I-beam becomes solid.
5. If the I-beam does not become solid, change the pitch angle (pull up or down on the collective), check range to the target and/or reduce your speed.

   The rocket I-beam cursor on the IHADSS remains dashed until you bring the target into horizontal and vertical constraints.

Engaging Targets with Hellfires

Longbow, Kiowa



Hellfires are used against heavier armored targets, such as tanks. There are two types of Hellfires — laser-guided and radar-guided (RF, or Radio-Frequency). The Longbow carries both types, while the Kiowa only carries laser-guided.

Laser- and radar-guided Hellfire missiles behave differently, depending on which target list and launch mode you have active. All Hellfires must be within range to fire. If the target is too far or too close, the Hellfire won't lock on or launch.

Hellfires can be launched in one of two modes: Lock On Before Launch (LOBL) and Lock on After Launch (LOAL). You can tell which you are in by looking in the lower right corner of your IHADSS or on your VSD in the Kiowa.

The combination of missile launch mode and the target acquisition mode determines how a Hellfire tracks its target. The target acquisition and missile launch modes for a missile are determined at launch time. Changing the modes in-flight does not affect the missile's behavior, except as noted below.

Note: *The only combinations available in Longbow Apaches without radar and in Kiowas are TADS/LOBL and TADS/LOAL.*

Direct and Indirect master modes. You can switch to Direct or Indirect master mode to quickly configure all of your avionics to launch Hellfires launching. *Direct* master mode switches you to LOBL missile launch mode, using TADS targets. *Indirect* master mode switches you to LOAL missile launch mode with FCR targets. Your IHADSS and MFDs also change — see **Master Modes**, p. 2.9.

LOBL Missile Launch Mode

- Requires a valid lock before launching.
- The Hellfire moves towards your current target with a low, shallow loft profile.
- You must maintain target lock throughout the missile's trajectory. If the target lock is broken, the Hellfire will self-destruct within a few seconds if you don't re-acquire a lock.
- The Hellfire can switch targets mid-flight, if the new target is in its field of view (but may not have time to adjust its trajectory).

With TADS Target Acquisition Mode/MMS

In TADS target acquisition mode or with the Kiowa's MMS, the missile is aimed at current TADS/CPG target. You can't use PFZs, but your CPG can sort your list by best missile targets (Alt T). This is the combination associated with Direct master mode.

With FCR Target Acquisition Mode (Longbow only)

Targets out of line of sight (LOS) cannot be engaged in LOBL because a valid lock is required for launch. In the Longbow's FCR target acquisition mode, the missile is aimed at your current FCR target, unless a PFZ is active. (If so, see below.)

LOAL Missile Launch Mode

- The Hellfire launches straight ahead with a high launch profile that puts the missile in a downward dive approximately 1km ahead of your aircraft. Once a target is designated, the missile maneuvers toward the target.
- You do not have to unmask (pop-up) in LOAL missile launch mode after launching your radar Hellfire. It re-acquires the target on its own.

With TADS Target Acquisition Mode

PFZs cannot be used. If firing from cover, you must fire before selecting a target, because the TADS/CPG list does not "remember" targets that are no longer visible.

With TADS/CPG Targeting Active

If a target within the missile's FOV (the large box on the IHADSS) is not designated in time for the missile to alter course, the missile self-destructs.

With FCR Target Acquisition Mode (Longbow only)

Targets out of LOS can be targeted because the FCR list stores target information from the Fire Control Radar, even when the targets are no longer visible. The missile goes after your current FCR target, unless a PFZ is active.

Launching Hellfires with PFZs

Longbow

PFZ with Laser Hellfires. The laser designator that guides these missiles cannot designate multiple targets. Therefore, you can only aim for your current target. See **Laser Operation**, p. 5.22, for more details.

PFZ with RF Hellfires. The first Hellfire launches toward the first target on your current PFZ list, regardless of your current target. The next Hellfire launched switches to the next target in the PFZ. This cycle continues through all targets on the list, then starts over, picking targets from the beginning. This lets you ripple-fire several RF Hellfires and simultaneously destroy different targets.

The Hellfire lock constraint remains on the IHADSS until the last Hellfire detonates. This lets you know you still have a valid line of sight to the target. If the box turns dashed, you've lost your line of sight and your lock (in the case of laser Hellfires).

Note: *If your current PFZ is deleted or de-selected, all launched missiles will self-destruct.*

Troubleshooting — Getting a Valid Lock

Longbow, Kiowa

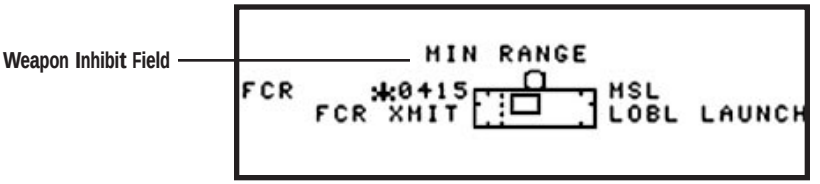
For Hellfires, getting and keeping a valid lock essentially means keeping the missile's seeker head pointed in a direction that allows it to find its target. When you choose Hellfires, a target box appears on your IHADSS. If you are in LOAL missile launch mode, this box is much larger than it is in LOBL missile launch mode.

The box marks the seeker's field of view. Position it in the general direction of your target; when it turns solid, you have a valid lock. If it is dashed, you do not have a valid lock. The text in the weapon inhibit field explains why you do not have a valid lock and helps you correct.

Weapon Inhibit Field

Longbow

Messages displayed in this field tell you whether you have a valid lock, and how to correct in order to get one if you don't. These messages are useful only for Stingers, MPSM FFARs and Hellfires, as HE FFARs use constraints instead of a lock.



VALID LOCK The target is valid and you can fire your weapon.

NO TARGET You do not have a target selected.

NO ACQUIRE Your radar (in FCR mode) or laser (in TADS mode) is off. You need to activate the appropriate target acquisition system before you can lock up a target.

ARM? Master Arm is set on "safe." (This is equivalent to the plastic safety cup that folds down over the weapons trigger in a real helicopter to keep the trigger from getting pressed accidentally.) Press Ctrl M to free your weapons.

NO MSLS You have run out of the type of missiles you've selected.

OUT OF RANGE The current target is beyond the maximum range of the current weapon. Choose a closer target or move toward your current target until it comes into range.

MIN RANGE You're too close: the current target is closer than the minimum range of your weapon. Engage with cannon if target is under 1km away, or with FFARs if it is under 3km away. Failing this, choose another target, or put more distance between you and your current target. Hellfire and Stinger minimum range is approximately .5 km.

SKR LIMIT (Seeker limit) The current target is outside of the field of view (FOV) of the current weapon. Yaw your aircraft so that your target falls within the missile constraint box of your Hellfires, or so that the "donut" representing the Stinger's seeker head can lock on the target.

LOS INVALID The current target is out of the line of sight for the current weapon. Something is between you and your target. If you have dropped down below cover, pop back up. If you can't bring the target into your LOS, choose another target. If you're forced under cover due to heavy fire (and are using Hellfires), try an LOAL missile launching.

INVALID TYPE The current target cannot be engaged by the current weapon (i.e., it is an air-to-air weapon and you have a ground target selected).

INVALID MODE You are in FCR acquisition mode and have a Radar Hellfire selected, but the FCR dome on your mast has been damaged. Switch to TADS target acquisition mode to fire.

Master arm vs. master mode. The *master arm* key switches your weapons from "arm" (fireable) to "safe" (not fireable). The *master mode* key changes your target acquisition mode, missile launch mode, IHADSS mode, and left and right MFDs to one of four different sets of presets.

Identifying the Target

The TADS and TSD give you information about your target with the symbols used to represent it (See **TADS MFD**, p. 2.32 and **Tactical Situation Display MFD**, p. 2.24).

For quick reference, you can toggle the Upfront Display (the box that normally displays radio frequencies) to show target ID info. This is a cheat, however, and not a feature in a real Army helicopter.

U Toggle Upfront Display

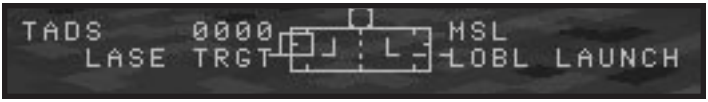
Laser Operation

Laser Transmitter

The game models the Longbow and Kiowa's external laser sensor, which guides laser Hellfire missiles and (in the Longbow) provides accurate range-to-target information for your chain gun. The laser activates automatically in most cases, but you can take manual control of it if you select REALISTIC TADS OPERATION in the **OPTION** menu (next page). Note that the REALISTIC TADS OPERATION option also activates manual laser operation in the Kiowa using the MMS.

LASE TRGT appears to the bottom left of the High-Action Display when laser targeting is active. A small asterisk also displays just above this text (by the range-to-target reading) and means that the laser is transmitting.

- Laser targeting gives you better range feedback (and thus, accuracy) when you're firing guns, and gives you pinpoint accuracy when you're using laser-guided Hellfires.
- LASE TRGT appears to the bottom left of the High-Action Display if laser targeting is active.



- In some missions, you must lock onto a certain target with your laser and hand off (laser designate) that target to another friendly aircraft in the area. (Your mission briefing will indicate which missions.)

  A radio message will indicate when a friendly is looking for one of your laser targets. The target you designate with the laser automatically gets sent to that particular friendly unit. If you keep it illuminated, you'll get a second message stating that he has picked up the laser-designated target.
- The laser turns off automatically if your target moves out of TADS camera view.

In some missions, you can turn off your laser and fire Laser Hellfires at targets designated by other units. You must have REALISTIC TADS OPERATION active. Simply cycle through targets until you get a VALID TARGET message in the Weapon Inhibit Field.

Realistic TADS and the Laser

Longbow

Before you can activate the laser, you must select a TADS target. Also, before you can manually toggle the laser on/off, you must select the REALISTIC TADS OPERAZTION option in the **OPTIONS** menu (under the Gameplay/Realism sub-menu). See the *Install Guide* for details.

Numpad [Enter] Toggle laser on/off (with TADS as active target acquisition mode)

You can activate the laser when you're using your chain gun. This is highly recommended, as it increases accuracy. You *must* have the laser active to fire Hellfire missiles in LOBL mode, however. If you try to fire them while the laser is off, you'll get a NO ACQUIRE message above the High-Action Display. (In LOAL mode, you can fire Hellfires with the laser off, but you'll have to activate it and lase the target before the missile's countdown timer reaches zero.)

- If REALISTIC TADS OPERATION is off, the laser activates automatically.
- If REALISTIC TADS OPERATION is active, but the laser is off, then your helicopter's weapon computer uses the best system available (usually the Fire-Control Radar). This can be inaccurate because targets may move before the FCR completes its next scan.
- If **REALISTIC TADS OPERATION** is active, but both the laser and FCR are off, then the weapons computer calculates the distance to the target based on the TADS camera angle and your current altitude. This is highly inaccurate, as it does not take things such as terrain into account.

Using the Laser with Laser Hellfire Missiles

🖱	Select Laser Hellfires in the *Mission Planner Arming* window
[Alt][O]	Activate REALISTIC TADS OPERATION in the **OPTIONS** menu
[Home]	Toggle TADS target acquisition on. TADS appears to the left of the High-Action Display
[Backspace]	Select Hellfire missiles
[Shift][2]	Switch to Direct master mode (activates LOBL missile launch mode and TADS/TSD MFDs)
[L] or [T]	Lock onto a target and wait for missile lock tone
Numpad [Enter]	Toggle laser on (this also gives accurate range-to-target information for the chain gun)
[Spacebar]	Fire Hellfire

WINGMEN AND BACKUP

Your wingman has the same mission you do, and is a valuable aid in remaining alive and achieving mission objectives. You control what weapons he carries, and you direct him to use these weapons as you see fit. His default orders are to protect you. Beyond that, you must direct his actions.

Wingman Commands

- You can radio orders to your wingman by pressing the wingman command keys.
- If you loaded Radar Hellfires onto your wingman's hardpoints, he has the ability to ripple-fire Hellfires and perform LOAL Hellfire attacks. This is useful when you establish Priority Fire Zones for your wingman. (To ripple fire, either your wingman must be in a Longbow, or you must be in a Longbow and hand off the targets to him.)

Giving Your Wingman Targets

Ctrl 3 Attack my target

Your wingman attacks your current target on command. You can give him a list of targets to attack by creating a PFZ on your TSD, selecting it, and giving the "attack my target" command. Your wingman will systematically attack all of the targets in this zone. The "attack my target" command supersedes the "weapons hold" command.

If you give orders to attack, but your wingman doesn't appear to be attacking, then he doesn't have a valid lock. Your wingman's responses (or lack of them) give an indication of how well he's doing:

"Attacking your target." He has found the target and has the right weapon to attack.

"Can't attack that target, sir." Either the target is out of range or he can't see it. If he can't see his target, and the target is in front of him, he will climb for a few seconds and try to get a better view. If he still doesn't see the target, he will drop to formation and radio you that he can't attack. He won't maneuver closer to a target if he's out of range; you will have to reassign him the target when you are in a better position.

"Can't attack that target, sir. We are Winchester ammo." He doesn't have the right weapon for the target (i.e., Hellfires/rockets for tanks/heavy armor; Hellfires/rockets/cannon for light to medium armor; or Stingers for air targets). He will move on to the next target, if he has one.

"We need a positive ID on target." You gave him a friendly to attack!

No response. You do not have a target selected or the PFZ you handed off to him is empty.

Getting Your Wingman's Targets

Ctrl 4 Pop up and scan area

Your wingman will pop up to about 200 feet, acquire targets, and return to formation. The targets he identifies automatically show up in your TSD. You can be in either TADS or FCR mode for this to happen.

Other Wingman Commands

Ctrl 5 Weapons hold

Wingman will hold fire. *This is his default status.* He will not engage unless you command him to, or an enemy aircraft attacks you. (This is the *only* instance in which he will engage without orders to do so.)

Ctrl 6 Weapons free

Wingman will fire on enemy targets that come within his sight.

Ctrl 7 Form on my wing

Wingman will join formation with you.

Ctrl 8 Check status

Use this command to check your wingman's current status. He'll radio back a message that indicates his weapons loadout status.

Ctrl 9 Stay here

Wingman stays in current geographical position and hovers.

You can use this command after downloading your PFZ targets (Ctrl Bksp) to your wingman. He'll stay in one spot while you move to another position. You can then attack targets from two directions. Make sure, however, that you return to your original position before ordering him into formation (Ctrl 7). Otherwise, he may fly directly over enemy units.

Ctrl 0 Change formation (toggle)

You can give your wingman formation commands that instruct him to fly 50m (default) or 150m away from you.

Ctrl H Return to base

If your wingman appears to be taking serious damage, you can use this to send him home. (He will return to your starting point.) You can call him back with the "form on my wing" command if he is less than 5km from you.

Ctrl - Attack ATA/ATG targets

You can specify what type of targets you want your wingman to attack when he's in *Weapons Free* mode. This command toggles between ATA (air-to-air) and ATG (air-to-ground) targets.

Ctrl + = Cover me

This command places your wingman in protective mode. He'll hold his fire unless something directly threatens you, at which point he'll attack. Any other wingman command cancels this one.

Ctrl Bksp Hand off targets

You can give your wingman this command to give him a target, but he won't attack it. He'll automatically go into *Weapons Hold* mode and won't fire until you give him the *Weapons Free* command. When you do, he'll attack that specific target first.

If you're using a PFZ, you can give him up to 16 targets (the maximum number of FCR targets he can store).

Calling on Backup

The Longbow and Kiowa were designed to sneak up on enemy forces and acquire targets. They can communicate target information to other friendly units in the air and on the ground.

Calling an Air Strike

Your air support consists of Air Force A-10s and F-16s. By calling an air strike, you can take advantage of their superior speed and arsenals.

To call an air strike:

1. Select any target from the FCR or TADS target lists.
2. Call in the airstrike with Ctrl 2.

Make sure you have taken out all nearby anti-air defenses first — otherwise, your fellow pilots may be shot down.

Calling an Artillery Strike

Nearby artillery units provide you with another resource.

To call an artillery strike:

1. Select any target from the FCR or TADS target lists.
2. Radio your target information in with Ctrl 1. In a minute, the shells will hit.

Enemy ground units can call in their *own* air and artillery strikes. Whenever they're under attack, they radio for help in the form of enemy choppers that scramble, or air or artillery strikes from nearby units.

COMBAT TACTICS

Longbow, Kiowa

To survive in the air and on the battlefield, pilots must employ both instinct and skill. The next sections discuss offensive and evasive tactics useful when flying under combat conditions.

The Longbow and Kiowa can perform these manuevers — however, the Black Hawk is too large and bulky for many evasive actions.

Air-to-Ground Tactics

The helicopter conducts a variety of ground missions, from low-altitude ambushes to anti-aircraft fire suppression. In some cases, a squadron of helicopters will work together, flying just above the surface to conduct covert attacks on enemy positions and accomplish the mission goals. Other times, a group of attack helicopters will coordinate closely with fixed-wing fighters to eliminate ground gun and tank positions in an all-out offensive attack.

In either situation, the most difficult challenge faced by a present-day gunship is how to approach enemy positions without being seen. Though maneuverable and able to fly at low altitudes and speeds, the helicopter is still vulnerable to surface-to-air missiles and patrolling fighters.

There are two tactics for approaching and attacking enemy ground vehicles, installations or bases. The first, *terrain masking*, allows the helicopter to approach targets unseen. *Contour chasing* is a useful alternative to this when enemy threat is minimal, allowing greater speed but less cover.

Once in position, the *bob-up* and *pop sideways* maneuvers are used to acquire nearby targets and fire off guided weapons from a concealed position.

Escorting Transports

Escorting Black Hawks to their landing zone is an important mission type in *Longbow 2*. While flying escort you want to stick as close as possible to the Black Hawk for most of the trip, to give him the maximum benefit of your sensors and jamming capabilities.

Once you get within about 5km of the LZ, however, it's time to break ahead to make sure the LZ is clear and safe before the transport arrives. Use both TADS and FCR to thoroughly check out an LZ. The TADS view is important, because infantrymen with SAMs — your most dangerous threat during a landing operation — won't show up on the FCR.

If the enemy does need to be pushed back from the LZ, FFARs are ideal for the operation. And, of course, this is the situation where your guns can really come into their own.

Terrain Masking

One of the helicopter pilot's priorities when flying in enemy territory is to avoid being spotted. Evading detection is not always easy, considering the recent strides made in radar and infrared scanning systems. A popular method of hiding as long as possible is the use of terrain as natural cover.

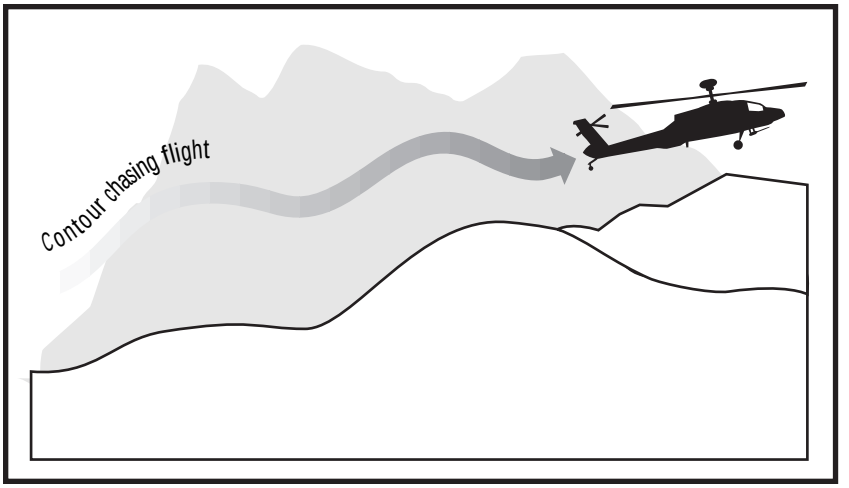
Also called Nap-of-the-Earth (NOE) flight, terrain masking involves following the contour of the surrounding terrain. Valleys, canyons and hills can all serve as cover for an attack gunship. Most radar systems are not sensitive enough to pick up targets traveling close to the terrain. Therefore, flying at lower altitudes often gives the helicopter pilot an advantage. NOE flight is usually conducted at around 20 feet (altitude above *ground*) and 50 knots airspeed.

Mission routes for modern-day gunships call upon relief maps of the local area to find possible screen cover. Paths are designated through foothills, around mountains and behind cluttered terrain. The pilot then has the tricky task of trying to maneuver in and around these barriers without crashing into them.

When flying in mountainous regions, pilots usually fly about halfway up the mountainside. Fighters flying overhead tend to search the valley's basin for enemy helicopters in hiding, and a craft halfway up its side — especially on the shady side of the valley — is hard to spot. The most dangerous problem with this method of avoidance is that mountainsides are notoriously gusty. The wind switches directions often, creating turbulent conditions that challenge the most skilled pilots.

Contour Chasing — Speed vs. Safety

Under normal cruising conditions, the helicopter uses level, straight-line flight and travels at about 110 knots. At these higher altitudes, speed is maximized and time is minimized, but detection is probable.



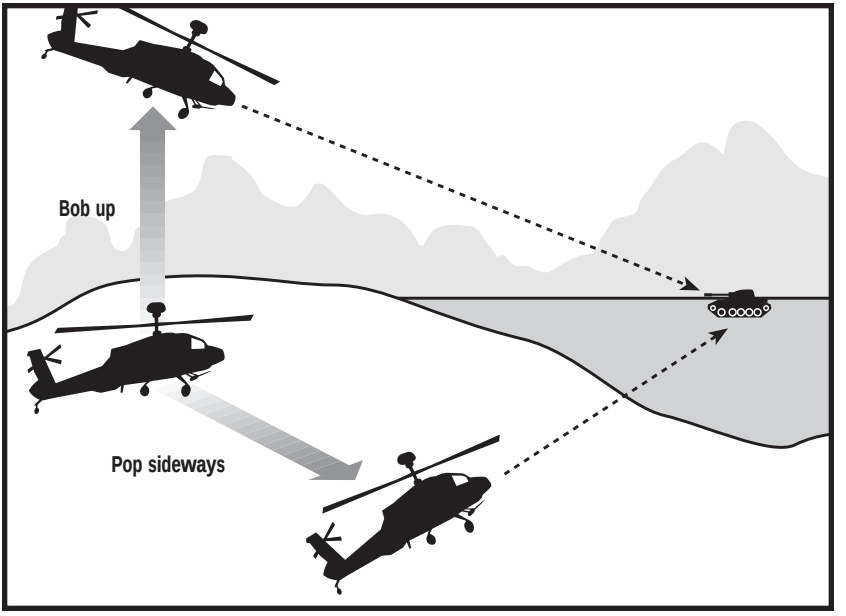
NOE flight, in contrast, is not linear and drops the craft's speed to approximately 50 knots. This type of flight path offers the best protection against overhead fighters, radar and infrared devices. At the same time, airspeed is quite low and makes the craft vulnerable to ground troops and rocket fire.

Contour-chasing offers a compromise between cruising flight and NOE flying. Contour-chasing entails flying about 40 feet above the ground at 80 knots or so and is often used when enemy forces pose minimal danger. Although it gives increased protection over the cruise method, the chance of detection still exists.

Bob-Up

The helicopter's most adaptive features are its hovering ability and maneuverability, both of which allow it to take advantage of natural terrain. This is primarily important when airborne helicopter forces are battling ground troops that carry mobile SAMs and hand-held rockets. Under these battle conditions, another maneuver called the *bob-up* can be combined effectively with terrain masking.

The bob-up is a simple yet effective maneuver that is used to acquire targets for guided weapons or designate targets for other incoming gunships. The pilot simply approaches the enemy position at an extremely low altitude, following the terrain. Once the pilot maneuvers into position, he must acquire targets and get a visual on enemy positions. By using masking, he can hover undetected behind a nearby terrain feature and bob up for a momentary glimpse.



In the AH-64D, the active Fire Control Radar system on the mast above the rotors reads enemy positions during these bob-ups and marks targets on the TSD display. Up to 250 targets can be stored simultaneously and uploaded via a data link to command posts or other friendly craft.

When a forward observer has designated such a target, or when the co-pilot/gunner is ready to fire off a missile, the helicopter simply rises a dozen feet or so, acquires a visual, fires off its weapons and descends. Then, the pilot may speed toward another masking object and repeat the process.

The bob-up maneuver was not originated by the Apache. In fact, it was used during the Vietnam war by Hueys seeking to limit their exposure to ground fire. In some cases, the pilot can fire weapons without exposing himself at all. A primary example is the Hellfire missile on the AH-64D Longbow Apache. A forward observer (either on the ground or in the air) can identify a target with a laser beam and transmit target information to a nearby attack helicopter. From hiding, the Apache can launch a Hellfire, which will travel over the terrain and seek out its preprogrammed target.

To activate the Bob-Up IHADSS mode, press Shift 6. See **Bob-Up IHADSS Mode**, p. 2.19.

Pop Sideways

Similar to the bob-up, the pop sideways maneuver allows the pilot to hide behind cover, emerging only to acquire targets and fire. The main difference is that in this maneuver, the movement into the open is sideways instead of vertical. This tactic requires a nearly perfect touch on the cyclic control and crashes are a real danger because of the lower altitude. However, less altitude translates into a better safety margin for the helicopter by limiting the line of sight of the enemy.

Air-To-Air Tactics

Because the skies offer little protection, air-to-air battles require vastly different tactics than air-to-ground battles. Your best strategy is to avoid air confrontation completely, and failing that, to destroy the enemy before he has a chance to fire at you. If you are unable to kill an enemy aircraft quickly, head for friendly airspace. If you do find yourself under air attack, the following tactics may help you.

A helicopter's best tactics in the air depend on what type of enemy it faces. In fighter-helicopter battles, the helicopter operates in a strictly defensive role and attacks only if the situation permits. Helicopter-to-helicopter battles, however, can lead to drawn out contests in which the pilots fight for supremacy.

No matter what type of air-to-air combat he participates in, the helicopter pilot must take advantage of the craft's maneuverability and rely on proven flight maneuvers.

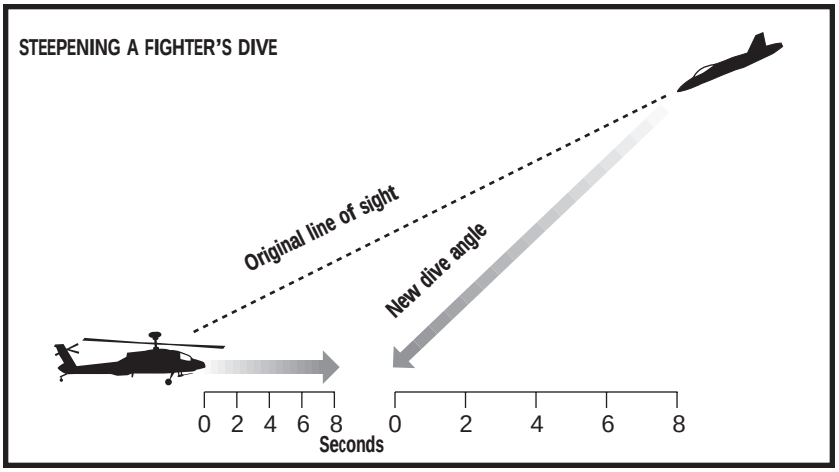
Against Fighters

Rarely will a helicopter and a fighter engage in combat — their strengths and weaknesses oppose each other, and neither has a decided advantage in battle. The helicopter boasts superior maneuverability over the fighter, and its ability to hover among ground cover gives it a chameleon-like edge. At the same time, the fighter maintains a speed advantage and usually carries a more powerful arsenal of ATA weapons.

These counter-complementary features usually mean that in such a conflict, the helicopter is concerned with defending itself while the fighter executes several well-thought-out passes before abandoning the conflict. No fighter pilot wants to sacrifice a multi-million dollar jet for a single helicopter kill. After all, the helicopter is capable of swinging 180° and firing its own ATA missile as the fighter completes its pass.

As fighters are never helicopter objectives, your best bet is to avoid them as much as possible, and bug out if you need to. Avoid detection by maintaining a hover close to the ground or near cover. Not only does this make you more difficult to track, it also renders the fighter's radar and weapon tracking systems ineffective. The air-to-air missile guidance systems on most fighters are incapable of distinguishing between moving ground vehicles and NOE-flying helicopters.

In the event that you *are* spotted, try getting off the first shot. This will distract the pilot and disrupt his immediate attack run plans. If the fighter dives at you head-on, speed directly toward him without increasing your altitude. This steepens his angle of descent, and he will likely overshoot or abandon the dive to avoid colliding with the ground.



Against Helicopters

The most obvious effective countermeasure for an attacking helicopter is another helicopter. Once the machines are evenly matched, the contest becomes a matter of piloting skill, not a test of speed vs. maneuverability. And because helicopters are slow and inherently evasive, the engagement is not likely to end quickly.

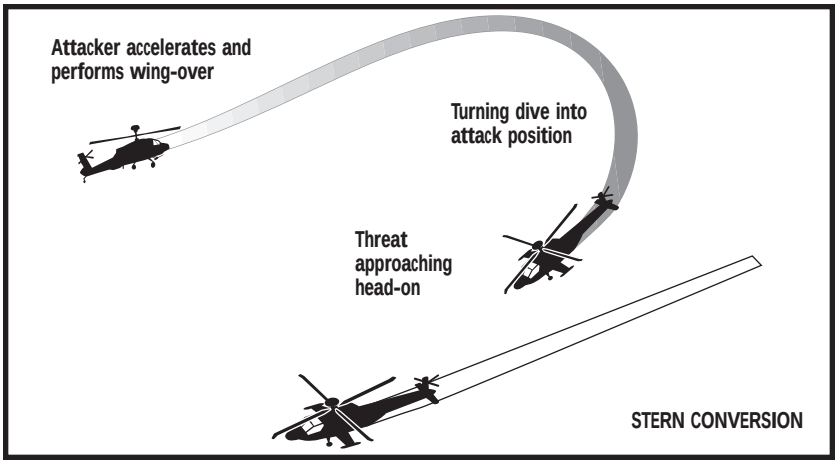
To date, few helicopter-helicopter battles have been recorded, and air-to-air combat consists largely of unproven theory. The maneuvers described here take into account both the abilities of rotary craft and existing combat tactics, but are subject to change as helicopter warfare evolves.

Stern Conversion

The best position to hold during a helicopter battle is the *stern position*, up and behind your target, around six o'clock high. When a helicopter threatens you head-on, the stern conversion is a quick way for you to gain a superior firing position.

[↓], [=] and [→] or [←]	1. Accelerate into a climb, turning slightly to one side.
[←] and [[] or [→] and []]	2. As you flare out into the apex of your turn, swivel back toward your opponent and dive into an attack position. Your dive will increase your speed, and you should be able to sight your guns on the target's tail rotor.
	3. Your high position keeps the opposing gunner from shooting through his own rotor disc — fire off a few rounds before he gets the chance to counter.

If your opponent executes a conversion against you, try countering with the same maneuver. Be careful, however; countering and re-countering with this move causes both craft to gain altitude. If AA guns or hand-held rocket launchers are nearby, both of you expose yourselves to extra danger.

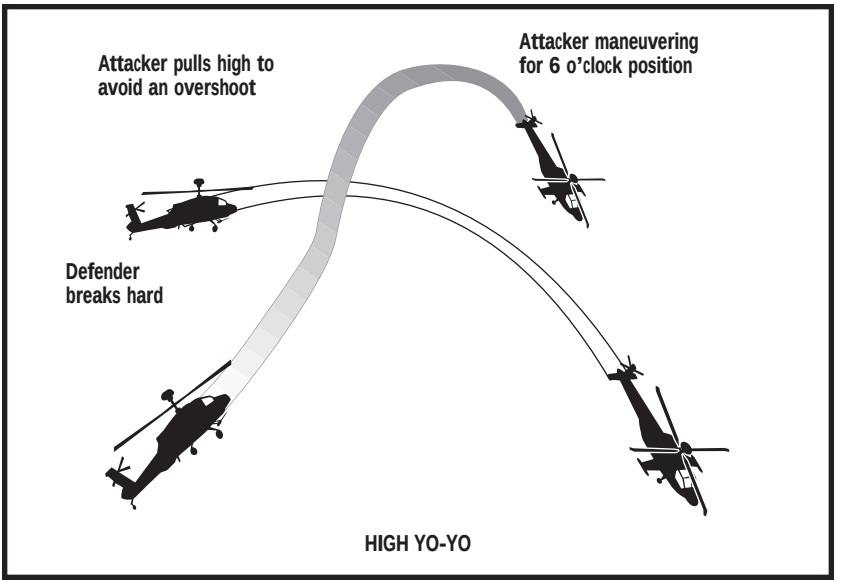


High Yo-Yo

The high yo-yo is a recovery method used to regain the six o'clock high position after an overshoot. When you attack a target from the stern position, keep your helicopter slightly behind and to one side of your opponent. As you make a run toward the enemy, he will almost always turn into your attack in an attempt to cut you off and limit his time in your sights.

If this happens:

↓ and + =	1. Pull the nose high to climb sharply.
← and [or → and]	2. Immediately pivot your craft in the direction of the enemy's turn.
↑ and - _	3. Once you've got him in front of you, dive to regain the above-behind stern position.



HIGH YO-YO

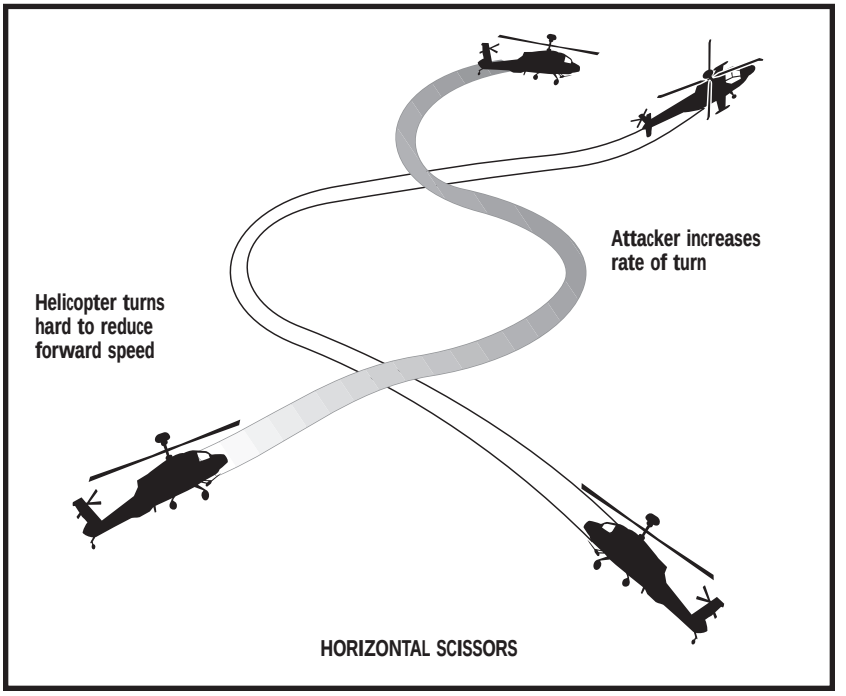
Horizontal Scissors

When you and a threat are flying in the same direction and approaching from an angle, try the horizontal scissors maneuver. This tactic consists of a series of hard, weaving turns intended to bring the target across your weapons envelope (the area covered by your guns).

If you make the first attack:

1. Make your first side run toward the enemy and release fire.
2. Then, turn hard back toward your opponent. This accomplishes two things — it bleeds off forward speed and brings the enemy into your sights. ([and ← or] and →)
3. As the enemy turns back toward you to cut off your angle, fire a second time.
4. Once you've passed your target, increase your rate of turn and go for a third run. ([and ← or] and →)

You can continue this scissors movement as long as you feel like you maintain the advantage.

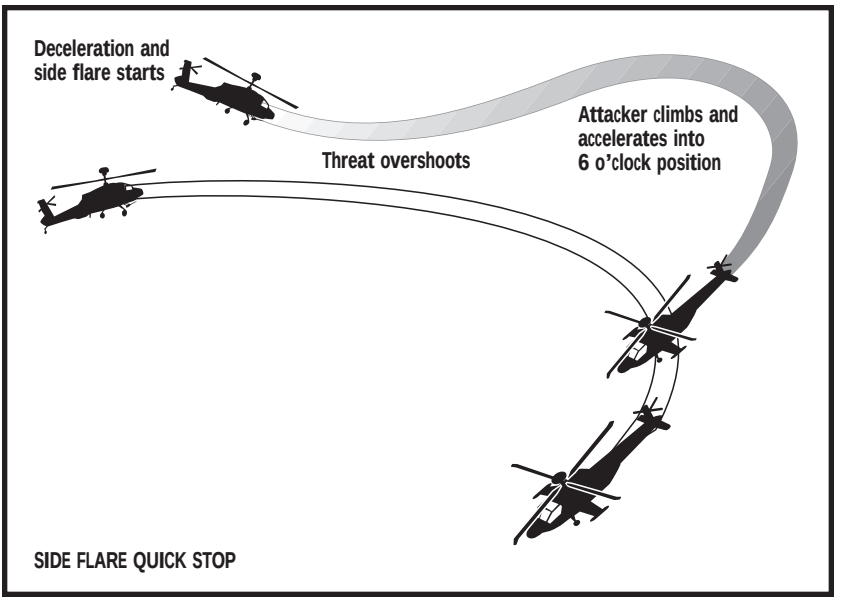


HORIZONTAL SCISSORS

Side Flare Quick Stop

The side flare is a defensive maneuver developed to stave off an attacker at close range. At the same time, it places you in an offensive position. If you find yourself taking fire to your rear, this move can help you shake the threat by reducing your speed and providing altitude.

↓	1. First pull back on the cyclic stick to curtail your forward speed.
[or], then ← or →	2. Then, kick the tail slightly outside and swivel into a banking turn. The direction of your turn should follow that of the attacker's. (If the threat is not turning, he will likely follow you into your turn.)
↑ and + =	3. As you turn, accelerate into a climb by increasing both the collective and cyclic. The forward speed you lost earlier should bring the threat to the twelve o'clock low position.
↑ and − _	4. From here, you can dive into an aft attack.



SIDE FLARE QUICK STOP

6
Campaigns

6. CAMPAIGNS

This chapter is a compilation of articles from magazines published by Jane's Information Group, including *Jane's Intelligence Review*, *International Defense Review*, *Jane's Defence Weekly*, *Foreign Report* and *Jane's Sentinel*. All text appears in its original form, although some articles have been abridged due to space constraints.

IRAN, AZERBAIJAN AND THE US

General Background	Gives insight from Jane's suite of magazines into the conflicts and current happenings in Iran, Azerbaijan and the United States.
Jane's Sentinel – Iran	Background information and regional relations/disputes between Iran and its neighbours.
Jane's Sentinel – Azerbaijan	Background information on Azerbaijan and current regional tensions.
Game Campaigns	Information on the game's campaigns (Operation Fallen Crescent and the National Training Center).

Fear Drives Caucasian Policy

Publication	*Jane's Intelligence Review - Pointer*
Date	1996 June 01
Volume/Issue	003/006
Section	Middle East
By Line	Hazhir Teimourian

The joint press conference in Baku of the foreign ministers of Azerbaijan and Iran on 3 March was meant to convey an image of friendly relations between the two Muslim neighbours. Instead, it ended in a diplomatic disaster when Iran's Dr Ali-Akbar Velayati asked to be excused from saying goodbye to President Aliev; instead, he headed straight for the airport.

The conference began well with Dr Velayati announcing every hope of improving economic and cultural ties with Baku. Then he was suddenly contradicted by Hassan Hassanov, the Azerbaijani foreign minister, who accused the Islamic Republic of Iran of aiding the Christian state of Armenia which had occupied a fifth of Azerbaijan. Dr Velayati counter-attacked by saying that the republic of Azerbaijan had allowed "Israeli agents" to penetrate the new Muslim countries of Central Asia, neighbours of Iran. To this, Mr Hassanov replied: "As far as we know, it's your Armenian friends who have killed 30,000 Azeri Muslims and made a million others homeless."

The scale of the disaster becomes clear when it is remembered that twice as many Azeris live in the northwestern provinces of Iran than in the new republic with its population of seven million. Iran is under pressure from its own Azeris to incline towards their brethren north of the border and has tried hard to hide to what depths its relations with Baku have plummeted.

Now, it is all in the open. So far, no large-scale trouble has erupted among Iran's Azeris, largely because of their shared Shia religion with the ruling Persians, as well as on account of prominent individuals of Azeri origin being in the leadership of the state, including Ayatollah Ali Khamenei himself.

"As yet, we have had no signs of a pan-Turkish movement in Iranian Azerbaijan, although some groups in Ankara and Baku are doing their best to incite one," says Dr Sadegh Zibakalam, a commentator at Tehran University. "This emboldens the government to take risks in the Caucasus. There are also lesser frictions, for example over the exclusion of Iran from the Caspian oil fields of Azerbaijan."

The recent agreements to exclude Iran from the international consortium to export Azeri oil from the Caspian Sea and Kazakhstan's search for a route for its future oil pipeline through Russia or Turkey, rather than nearby Iran, came as hammer blows to Iranian pride, whether Islamist or secular. The fact that Turkey is also a US ally, and even signed an agreement with Israel to allow that country's fighter aircraft to fly along Iran's western borders, adds extra ideological and security elements. Given that the long-term rivalry between Sunni Turks and Shia Iranians is unlikely to diminish, even if there were a new revolution in Iran, it would appear to serve Iranian interests to maintain the present physical barrier between Turkey and the Turkic speakers of the Caucasus and Central Asia. At present, this barrier consists of the Christian states of Armenia and Georgia.

Iran Warns USA To "Think Twice" About An Attack

Publication	*Jane's Defence Weekly*
Date	1996 June 12
Volume/Issue	025/024
Section	Middle East/Africa
By Line	James Bruce

Iran's land forces commander, Brig Gen Ahmad Dadbin, has warned the USA to "think twice" about launching any military action against the Islamic republic.

"We're strong enough to defend ourselves, whoever the aggressor may be," he said in an interview published in the Kayhan Havai weekly newspaper on 2 June.

Gen Dadbin said the Velayat (Guardianship) exercises held by the regular army and air force in the Koushk-e-Nosrat desert south of Tehran last month by 200,000 troops – the largest peacetime manoeuvres conducted since the 1979 Islamic revolution – demonstrated the military's readiness and strength.

"The Americans should think twice before attacking us," he said. "I believe no country in the world would dare to attack us."

The USA, which is striving to isolate Iran economically, has issued no particular threat of military action against the Islamic republic despite repeated allegations that it sponsors terrorism and seeks to acquire nuclear weapons.

Iran Strives To Regain Military Might; Rearmament Drive Aims to Restore Gulf Balance

Publication *International Defense Review*

Date 1996 July 01

Volume/Issue 029/007

Section Strategic & Security Issues

By Line Anoushiravan Ehteshami

As the Cold War drew to a close, Iran entered into a military relationship with the Soviet Union. Although this event marked a period of growing Western interest in Iran's arms-procurement policy and its military and security alliances, it was not until Iraq - the region's strongest force between 1980 and 1990 - was defeated in the 1990-91 Gulf War that this interest became of major concern to Western powers and their regional allies.

In particular, the types and quantity of advanced weapons systems being added to Iran's arsenal, as well as the level and degree of training offered by suppliers, were alarming observers in the West. Concerns focused on the impact of Iran's new military hardware on its offensive-operations capability, the technical and technological sophistication of its armed forces, and how these enhancements might aid Iran's non-conventional weapons capability.

Contrary to some Western perceptions, it is important to consider the reasons behind Iran's rearmament drive. The war with Iraq ended Iran's military superiority in the region, it depleted the country's arsenal to an alarming extent and it created a technological gap between Iranian forces and those of other Gulf states.

In the absence of Iraq as a countering influence in the area, Iran's strategy – and its impact on the Gulf region's military balance – is of great concern to Western defense analysts.

From Russia, Iranian purchases have included: aircraft; tanks and armoured vehicles; artillery and multiple-launch rocket systems; air-to-air, air-to-surface, surface-to-air (SAM) and surface-to-surface missiles (SSMs); munitions; electronic-warfare equipment; submarines; and airborne early-warning platforms. Iran already possesses over 50 F-7 (MiG-21 equivalent) and 12 F-6 (MiG-19 equivalent) fighters and interceptors, in addition to 260 T-59 MBTs and SAMs from China.

In view of the political and military importance of Russia to Iran (notwithstanding Russia's political importance to Ukraine), neither Tehran nor Kiev appears prepared to jeopardize relations with Moscow for a short-term arms deal. Such concerns naturally inhibit the growth of Iranian-Ukrainian military relations.

Two sticking points remain, however, in Iran's rearmament drive:

- the deployment of three Russian Kilo-class submarines, the largest submarine capability in the Middle East (with 2,500t surface displacement). This deployment has been a long-time ambition, reflecting the rising influence of Iran beyond its southern borders in East Africa, the Red Sea (Port Sudan in particular) and around the Indian Ocean; and
- the deployment of advanced missile systems, including SSMs, SAMs, anti-ship and ship-based missiles.

Iran's arms imports may not pose an immediate and serious challenge to its southern neighbours, or to Western interests in the region. Nonetheless - leaving the unpredictable issue of Iran's nuclear program aside - the continuing build-up of Iranian armed forces, its military operations in the Gulf, its military preparations along its borders, and its sustainable supply of weapons from sources not open to US control, have provided sufficient cause for the US to intensify its containment strategy towards Iran.

Baku and Tehran, Renewed Tensions

Publication *Jane's Intelligence Review - Pointer*

Date 1996 Nov 01

Volume/Issue 003/011

Section Europe/CIS

By Line Felix Corley

The always turbulent relations between the governments of Azerbaijan and Iran have become rockier of late, with a number of issues bringing latent tensions to the surface once more.

On the Iranian side, there was a perception that Baku lent support to anti-Iranian demonstrations by the large ethnic Azeri community in northern Iran in April. Irritation with Baku was renewed in May with the arrest of a number of activists of the Islamic Party, including its leader Akram Aliev. The Azerbaijani National Security Party accused them of spying for a foreign power. This was a clear reference to Iran, as the men were known to maintain links to the Iranian embassy in Baku. In addition, exiles from Iran's Azeri minority, now based in Azerbaijan, have been using their new base to call for an end to Iranian rule over 'Southern Azerbaijan' (the Azeri-populated regions in the north of Iran). Most prominent of these has been Piruz Dilenji, chairman of the South Azerbaijan National Liberation Committee, who has continued his campaigning with the tacit approval of the Azerbaijani authorities, despite the official line from Baku of non-interference in the issue of separatism in the Azeri-populated part of Iran. Iran has been seeking Dilenji's extradition, an application that Azerbaijan is likely to resist.

On the Azerbaijani side, there has been annoyance at recent calls in Iran for regions of the Caucasus to be annexed to Iran. In August, tens of thousands of ethnic Azeris in Iran signed a petition demanding the 'return' to Iran of 17 cities in the Caucasus, including the Azerbaijani capital. The petition called on the leadership of Azerbaijan to 'be courageous and recognise historical facts' and accede to these demands.

There is also suspicion in Baku that Iran is using fundamentalist Islam as a spearhead to undermine the regime of President Heidar Aliev. Religious education of young Shia Azeris across the border in Iran is viewed as cover for training in Islamic subversion. To add to Azeri displeasure is the widely held perception in Baku that Iran's professed neutrality in the Armenian-Azeri conflict over the Armenian-populated enclave of Nagorno-Karabakh is lopsided in favour of the Armenians. The Azerbaijani government has already complained to Tehran of Iranian economic support for Armenia, a complaint repeated to the Iranian foreign minister when he visited Baku in the summer. The visit ended badly.

Since then the two sides have taken steps to put relations back on an even keel. Azerbaijan's foreign minister travelled to Tehran on a two-day official visit in late August, when he assured President Rafsanjani that Azerbaijan wished to improve

relations. Hasanov also met Iranian Foreign Minister Velayati and discussed a forthcoming meeting of foreign ministers of the Caspian littoral states. This will propose a new ruling on the division of the Caspian. During the visit, the Iranian parliamentary speaker, Ali Akber Nateq-Nuri, expressed his anger at hostile Azerbaijani media coverage of Iran.

When Heidar Aliev took power in Baku in 1993 there was relief in Tehran that the Popular Front regime of Abulfaz Elchibey, with its fiercely anti-Iranian rhetoric, had at last fallen. Elchibey had aroused great hostility in Iran with his open calls for the creation of a Greater Azerbaijan, incorporating Azerbaijan and northern Iran. He had also been especially close to Turkey and supported the creation of a strong pan-Turkic axis, from Turkey through Azerbaijan and on to the mainly Turkic states of the former Soviet Central Asia, something that Iran has been anxious to resist. After Elchibey's fall, Tehran looked for more stable relations with his successor. Aliev, with his Soviet nomenklatura background, appeared to be much more distant from Turkey and looked as though he would draw Azerbaijan closer to Russia and Iran. However, despite these initial favourable moves (from Tehran's point of view), relations have not improved on a long-term basis. Azerbaijan's relations with Turkey and the West have improved, while relations with Moscow remain cool. Adding to the annoyance in Tehran was the fact that in April 1995 Baku succumbed to Western pressure to cut Iran out of the Caspian Sea oil consortium. As the latest tensions show, there are still numerous bones of contention between Baku and Tehran.

Yet, despite friction in relations, the two states have to cooperate, if only for the sake of their economies. Trade between the two is still increasing. The question of resources in the Caspian Sea has led to differences in the past. Iran favours the Russian view that the Sea is in fact an inland lake and that all resources should be shared between the littoral states. Azerbaijan has been the most vociferous in asserting its exclusive right to the mineral wealth in what it considers its part of the Sea, especially now the extent of its oil and gas reserves are known. However, Iran can only benefit from increased stability in its neighbour to the north.

Azeris Want New Look at Tashkent Accord

Publication	*Jane's Defence Weekly*
Date	1996 Dec 18
Volume/Issue	026/025
Section	Briefing
By Line	Tony Banks

Azerbaijan's armed forces would like to renegotiate the Tashkent Agreement for the sharing of former Soviet weaponry, but not at the expense of Russia gaining more materiel, a senior army officer told *Jane's Defence Weekly*.

The source, who wished to remain anonymous, pointed out that Azerbaijan has longer borders and more citizens than Armenia and Georgia - something not considered when the agreement was signed. He complained that weapons continue to reach Armenian forces, which, despite the May 1994 ceasefire, are still in a state of war with Azerbaijan over the disputed region of Nagorno Karabakh. The officer said small arms fire is exchanged daily between Azeri and Armenian forces despite reports that the ceasefire is holding.

He [the source] said that Armenia has failed to implement UN resolutions in the area and that NATO, under the terms of Partnership for Peace, should recognise this and take action against Armenia.

"We hope to find a peaceful solution to this problem," he said, but according to Western diplomats in Baku, no Azeri politician would be able to hold office without declaring his intention to recover captured areas by force, should negotiations fail.

This, however, appears to be rhetoric rather than reality. Azerbaijan has signed major contracts with Western consortia for the exploitation of its oil wealth and it fears any renewed large-scale fighting would, at the very least, delay pumping and much needed foreign income.

Azerbaijan's own frail internal political system and fears for the future of Russian President Boris Yeltsin are also cause for concern in Azerbaijan. Since gaining independence in 1991, Azerbaijan has faced coups, revolts, mutinies, states of emergencies and separatist threats as well as joining, leaving and rejoining the Commonwealth of Independent States.

The country is held together by President Heydar Aliev, but he is ageing and appears to have no suitable successor. An internal power struggle is likely and the popular policy of retaking Nagorno Karabakh by force may swing the balance in any leadership struggle.

Although Azeris downplay the possibility, they fear that an expansionist Russian leader may replace Yeltsin. First on the list for "reintegration" may be Azerbaijan and its oil fields, some Azeris believe, but not before the wells and pipelines are pumping.

The Jane's Interview: National Training Center

Publication	*Jane's Defence Weekly*
Date	1994 June 04
Volume/Issue	021/022
By Line	Joris Janssen Lok

First impressions from the US Army's advanced warfighting experiment indicate that the service's Aviation Restructure Initiative is on the right track. Maj Gen Dave Robinson, Commander, US Army Aviation Center, spoke to Joris Janssen Lok.

The impact of real-time intelligence has proven to be one of the biggest revelations during the "Desert Hammer VI" advanced warfighting experiment at the National Training Center (NTC), Fort Irwin, California, Maj Gen Robinson said in his office at Fort Rucker, Alabama.

"The AWE tested the high technology equipment we are applying to the force. Advanced communications, the ability to see the enemy and to produce the right intelligence, we had an array of it out at NTC," he said.

"This AWE produced so much data, we are still peeling back the onion on that. It showed, however, that the ability to obtain and distribute intelligence in real-time will have a great impact on our warfighting capability. It may provide the ability to flatten your organization, to empower your battle captains and to stay in contact through advanced communications."

Besides heavy armour, infantry and artillery, army aviation was a key player during "Desert Hammer VI", contributing OH-58D Kiowa Warrior, AH-64A Apache and (simulated) UH-60 command and control helicopters.

Gen Robinson said the results vindicated his efforts to aggressively reduce the size of the army's aviation fleet by turning it into a "smaller, but hugely more capable" force. This goal is encompassed in the Aviation Restructure Initiative (ARI), which was produced under Gen Robinson's tenure as Aviation Branch Chief and accorded last year.

According to Gen Robinson, the RAH-66 Comanche is the centrepiece of ARI. "That's the quarterback of the future electronic battlefield. It replaces 1960s-technology AH-1 and OH-58A/C aircraft in the air cavalry units and attack battalions. It allows a redistribution of the OH-58Ds," Gen Robinson said.

Comanche, the armed reconnaissance system operating alongside AH-64D Longbow Apaches in future attack helicopter battalions, will be "enormously capable of gathering information, making it available to others to bring to bear the lethal effects of such players as artillery, air defence systems, navy Tomahawk and air force strikes."

JANE'S SENTINEL — THE GULF STATES — IRAN

Defence Production

Publication	*Sentinel - The Gulf States*
Country	Iran
Date	1995 Dec 20
Section	Defence Production

Iran now claims self-sufficiency in a number of important sectors. There are at least 10 battlefield missile development programmes in progress and first exports were expected to begin in 1993, under the auspices of the Defence Industries Organisation (DIO).

The defence industry has evolved through a number of distinct phases which started with the establishment of the Military Industries Organisation (MIO) at the beginning of the 1960s. Since then, a small domestic industry has gradually developed, producing machine guns and rifles under licence from Germany in addition to a number of plants manufacturing explosives, mortar rounds and small arms ammunition. Other workshops are assembling helicopters and military vehicles from imported kits.

By the late 1970s the industry had started to manufacture ordnance such as grenades, rocket launchers, artillery rockets, light artillery rounds and gun barrels. Most infantry weapon requirements and artillery ammunition up to 155 mm calibre are manufactured locally.

Iranian technicians have mastered the art of reverse engineering and the repair and maintenance of some extremely sophisticated Western equipment, however, including US HAWK surface-to-air missiles and the US TOW anti-tank systems.

A domestically produced main battle tank, the creation of which was announced in March 1994, is apparently another step in Iran's effort to develop a domestic defence industry. The new tank has been named Zulfiqar, after the sword of Ali, a legendary Islamic hero. It is described by the Pasdaran Construction Crusade as an "advanced tank" of superior manoeuvrability and speed.

In 1992, however, the now defunct Russian export agency Oberonexport came to an agreement with the Pasdaran Construction Crusade to transfer certain technologies for the T-72 and T-80 to Iran in exchange for oil products to the value of US $7.8 billion.

Historical Overview

Publication	*Sentinel – The Gulf States*
Country	Iran
Date	1995 Dec 20
Section	History / Historical Overview

Iran is an ancient country with a history dating to the empire of Cyrus the Great, founder of the Persian Empire in the 6th Century bc. For much of its history Iran has been a monarchy, with the Shia clergy playing a prominent political role.

In 1906 the first Imperial Constitution established an elected parliament (Majlis). European industrialisation and the resultant expansion in capability and power gradually exposed Persian political weaknesses, the country soon coming to be dominated by the new continental powers, the United Kingdom and Imperial Russia in particular. Both were attracted by the country's strategic importance and were to occupy parts of the country at various times.

In 1944, while Soviet troops were in the northern Azerbaijan province, Moscow demanded concessions for the exploration and exploitation of oil in the northern part of the country. The leader of the Iranian National Front, Mohammad Mosaddeq, launched a campaign against the granting of concessions to any foreign power and agitated for existing agreements to be revoked. Meanwhile, the Democratic Party of Azerbaijan, which was manipulated by Moscow and supported by Soviet troops, seized power and declared Azerbaijan's independence. British Commonwealth troops left Iran in 1946, although Soviet forces remained.

Territorial Disputes – Iraq, UAE

Publication	*Sentinel – The Gulf States*
Country	Iran
Date	1995 Dec 20
Section	Threat - External / Territorial Disputes - Iraq, UAE

Since the end of the war with Iraq, tensions on Iran's borders have increased, forcing Tehran to seek improvements in the capability of its military machine. The aftermath of the Gulf conflict led indirectly to a threat from the United Nations-imposed Kurdish autonomous zone in Iraq. This has given encouragement to Iran's Kurdish minority in the north.

Iraq's defeat in the Gulf conflict has certainly delayed any attempt by Saddam Hussein to revive the two countries' border dispute. Nonetheless, Tehran expects future claims by Baghdad in its effort to secure access to the Gulf.

The collapse of the Soviet Union and the emergence of newly independent republics on Iran's northern borders have made it necessary for Tehran to develop relations with Azerbaijan and Turkmenistan. Despite sharing religious affinities,

Iran cannot guarantee the security of its northern borders.

Iran lost a C-130 transport aircraft in February 1994, shot down in error by Armenian forces who thought the Moscow-Tehran flight was engaged in a spying mission. Iran has expressed intense concern at the possible spill-over of the Armenian-Azerbaijan conflict.

According to Washington, the threat of a nuclear-armed Iran is the one which causes it most concern. It has been reported that North Korea has been paid US $600 million by Iran for the further development of the Nodong missile, in order to deliver a nuclear or chemical warhead capability. These allegations have been made but never proved, however. Whether or not they are true, Washington is likely to keep up the pressure on Iran.

International Affairs

Publication	*Sentinel - The Gulf States*
Country	Iran
Date	1995 Dec 20
Section	International Affairs

Since the overthrow of the Shah and the creation of the Islamic Republic there has been considerable concern in the West and in moderate Arab states that Iran is spreading Islamic fundamentalism throughout the Middle East and beyond.

Iran has developed close contacts with Bosnia-Herzegovina, China, North Korea and Sudan. Tehran vies with Turkey for influence in the Central Asian Republics of the former Soviet Union. It has been accused of supporting terrorist groups active in Lebanon, Israel, Northern Ireland and Egypt.

Iran's international image is one of subversion and interference in the internal affairs of neighbouring nations. Some of the more conservative countries in the Middle East and North Africa view Iran's foreign policy as one of fomenting revolution, of de-stabilising Muslim countries and of exporting terrorism.

Alliances & Alignments

Iran is a member of the Organisation of the Islamic Conference and considers itself non-aligned. Its foreign policy during the Cold War was based on condemning both the USA and the USSR. Relations with Russia have been closer than with America and Tehran now seeks to use its military ties with Russia to counterbalance American pressure. Iran has developed cordial ties with China and North Korea as a result of the willingness of the two communist states to supply it with sophisticated arms, such as ballistic missiles.

US officials claim that:

- Iran funds and trains Hamas, Hizbullah and Islamic Jihad;

- Iran has occupied the Abu Musa and Tunb island groups in contravention of international law and its treaty obligations with the United Arab Emirates;
- Iran is building ballistic missiles, researching chemical weapons and developing other weapons of mass destruction, possibly with North Korea, another US bete noire.

In general terms, the USA is concerned that Iran's current political regime is oppressive and imperialistic. It is regarded as a danger to trade and culture in the Middle East and beyond. Following the end of the Iran-Iraq war, Tehran approached the Soviet Union for military assistance to re-build its shattered defences. Initial plans called for a US $2.5 billion barter deal to include main battle tanks, field artillery and armoured vehicles. This was later extended to include air defence missile systems and combat aircraft.

By 1992 the arrangement had been formalised by a memorandum of understanding between Moscow and Tehran. The latter provided high technology anti-shipping missiles and main battle tanks, including the Sunburst missile in coastal defence configuration and Kiev-built versions of the T-80 tank.

Tehran and Moscow still have much in common, despite the apparent agreement of Russia not to supply nuclear technology to Iran after the Russo-American Summit. Moscow has supported the Tehran line regarding Azeri oil drilling contracts in the Caspian Sea, for example. On 17 May 1995 the Russian Federation announced that it disputed the claim of Azerbaijan that it was legally entitled to award oil drilling contracts in the Caspian Sea to Western nations, including the US $7 billion agreement with British Petroleum, signed in 1994. Moscow claims that treaties signed in 1921 and 1940 with Tehran are still in force and these say that only the Soviet Union and Iran can award oil drilling and exploration contracts.

Despite the apparent setbacks in bilateral relations which resulted from the Clinton-Yeltsin Summit, Iran announced the same day that it would back the Russian Federation's claim that treaties were still valid. Iran apparently supports the Russian contention that joint rights are enjoyed by Tehran and Moscow only.

Relations with the USA

Tehran continues to use the expression "the Great Satan" to describe the Washington administration. There is no doubt that there is considerable mistrust on both sides. This has not been helped by the allegations of Iranian involvement in the bombing of the World Trade Center in New York and of Pan Am 103 over Scotland.

In late 1994 and early 1995 the Clinton administration escalated its campaign against Iran, alleging that it had a covert nuclear weapons programme and that it was building up its forces on Abu Musa. The accusations were motivated as much by the need to head off hard-line anti-Iranian pressure in Congress and to placate Israeli concerns as by any perception of a real threat from Iran. Rafsanjani meanwhile attempted to ease tensions by offering an oil production deal to a subsidiary of the US oil firm Conoco but President Clinton forbade the deal and imposed a trade embargo on Iran. The administration followed this up with a campaign to persuade Iran's trading partners to cut their ties with Iran, although this campaign has had limited success.

JANE'S SENTINEL — RUSSIA AND THE CIS — AZERBAIJAN

Risk Pointers

Publication	*Jane's Sentinel - Russia and the CIS - Azerbaijan*
Country	Azerbaijan
Date	1996
Section	Executive Summary

Risk Pointer 1

Azerbaijan is still resisting Russian pressure for a greater economic and military role. The ongoing dispute over the rights to exploit the Caspian Sea's massive oil resources has tarnished Azeri relations with Moscow. Azerbaijan wants to divide the Caspian into sectors per country, whereas Russia views the Caspian as "international territory" with all the Caspian states having "equal rights to its utilisation." Unlike the other Caucasus republics (Armenia and Georgia), Azerbaijan has consistently resisted increased military cooperation with Russia and opposes a greater Russian military presence in the region.

Risk Pointer 2

Tension persists with neighbouring Iran. In early April 1995, Azerbaijan was forced to withdraw, after pressure from the US Government, from a deal which assured Iran of a quarter of Azerbaijan's 20 percent share in the international consortium formed to develop the Caspian oil fields. This has led to increased Iranian-Armenian cooperation and in 1996 the Azeri government lodged a complaint with Iranian Foreign Minister Ali Akbar Velayati during his visit to Baku, concerning Iran's support for the Armenian economy.

Azerbaijan's Oil to Flow

Publication *Foreign Report*

Date 1996 Sep 26

Volume/Issue 000/2417

The so-called "Contract of the Century," a $10-billion scheme to bring oil from beneath Azerbaijan's bit of the Caspian Sea to western markets, will start soon. When going at full speed, it will alter the world's energy map and help to make Azerbaijan and Georgia financially independent of Russia.

The idea is to start to pump "early oil," which is easy to exploit, by next summer. It will take two routes. One will be north by pipeline to the Russian Black Sea oil terminal at Novorossiysk and thence, via the Bosporus, to overseas markets. On its way to Novorossiysk, it will pass through Grozny, capital of war-torn Chechnya, where installations have been damaged but not put out of action. Since the pipeline already exists, it should be possible to use it as soon as oil is pumped in fairly large quantities; the maximum for "early oil" is about 100,000 barrels a day.

The second route will be through Georgia to the Black Sea terminal of Poti. An old pipeline along part of the route needs to be refurbished, and a new pipeline has to be built along the rest of the route. It should be ready by 1998. The oil pumped to Poti may be shipped across the Black Sea to Romania (for countries on the Danube-Rhine waterway by barge), Bulgaria (for Greece), Ukraine and through the Bosporus. This oil is now being marketed for long-term buyers.

The Big One

When the oil is produced at full speed at more than 700,000 barrels a day, however, a bigger pipeline and terminal will be needed. These have not yet been chosen by the BP-led consortium. However, we predict that it will choose a route from Baku, Azerbaijan's capital, through Georgia and Turkey to the Mediterranean port of Ceyhan (where a terminal already exists for Iraqi oil). This would take up to two years to build.

GAME CAMPAIGN BACKGROUND

Longbow 2 has two separate campaigns – one set in Iran, and the other at the National Training Center in Fort Irwin, California. You can fly both campaigns in either single-player mode or in multi-player mode. In multi-player play, another player can control your helicopter's pilot or CP/G functions, fly as your wingman, or pilot a second wing. (See the *Multi-Player Guide* for additional details.)

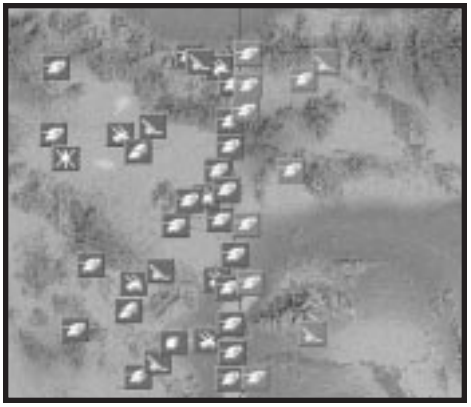
National Training Center

The National Training Center is essentially a high-tech battlefield for special forces and troops to test their endurance and skills during a virtual war. At the core of the realistic exercises conducted here is M.I.L.E.S. (Multiple Integrated Laser Engagement System), a high-tech infrastructure of laser-sensitive equipment.

This computerized engagement system incorporates laser-tipped guns and tracking sensors mounted onto trucks and infantry battle gear. In combat scenarios, lasers take the place of live rounds, M.I.LE.S. tracks battle phases and casualties, and fiberglass bodies transform American equipment into foreign battefield targets.

At the NTC, forces undergoing training receive background information and briefings detailing task force missions in a fictional country. Hostile situations and mock battles are treated as if American troops were operating in a foreign region under actual combat conditions. The enemies in each case are US OPFOR (Opposing Force) troops, or units specifically trained to look, think and move like the enemy. In 1995 protocol dictated that OPFORs practice Soviet battle tactics, although this is subject to change as regional tensions shift.

The dynamic NTC campaign in the game is a excellent method for novice pilots to practice and perfect the tactics and battle skills necessary for combat. You'll gain the same experience you would in an actual dynamic campaign, but you won't suffer casualties or expend weaponry unnecessarily. Once you've successfully led several task forces through the NTC, you'll be ready for real warfare.



Iran: Operation Fallen Crescent

The dynamic campaign generator behind the Iranian missions is a battlefield simulation system designed to create unique scenarios each time you replay the game. (See **Game Campaign**, p. 6.16, for more information.) Within each battle, you act as the ABC, or Air Battle Captain. Although you have specific objectives to accomplish in each mission, you issue customized tasking orders to other aircraft wings, designating navigation routes, waypoint assignments, weapons loadouts and synchronized strikes on priority targets.

All missions in Longbow 2's campaign are fictional in nature, although the Iranian theater is a continuation of current events based on both fact and fiction:

FACTS. The preceding articles in this chapter, along with the next few paragraphs, give a factual background to the relations between and the situations surrounding Iran, Azerbaijan and Armenia.

It is fact that beneath Azerbaijan and the Caspian Sea lie billions of dollars of underground oil resources. Bordered by Azerbaijan, Armenia, Turkey, Iran and Russia, the sea is land-locked, making it impractical to maneuver oil tankers into the region. In 1995, several key U.S. oil companies joined an oil consortium with Azerbaijan. This consortium was to serve several purposes, the most important being the protection and extraction of these oil reserves. The consortium both alienated Iran – excluded from the consortium under American pressure on Azerbaijan – and further intensified non-combat conflicts between Azerbaijan and Iran.

To exacerbate the already-existing regional tensions, recent territorial disputes (from 1992 to the present) between Azerbaijan and neighboring Armenia over the Nagorno Karabakh region have brought about civil unrest. This Armenian-occupied strip was originally part of Azerbaijan, but balked at rejoining Azerbaijan after the dissolution of the U.S.S.R. Those that live in the region have formed an independent state, although it remains officially unrecognized.

Both Azerbaijan and Armenia want sole ownership of the Karabakh territory, and light-arms skirmishes are daily occurrences despite a series of shaky cease-fire agreements. Azerbaijani president Alieve has denounced "Armenian aggression" along this strip of land, including indiscriminate shelling of towns along the borders. Because of human rights violations, the fighting in this region has been the focus of several UN resolutions and has brought this conflict to the world's attention.

In spite of this instability, the oil consortium already has plans to extract and pump oil through existing pipelines to Novorossiysk and the Russian Black Sea. Later, construction is scheduled to begin on additional pipelines through Georgia and Turkey. It is hoped that these pipelines through areas with more political solidity and access to open sea will minimize conflicts in the region.

CAMPAIGN SCENARIO. The fictional basis of the campaign draws from the previously mentioned events and advances the situation into fictional warfare. Preceding the game's campaign, oil extractions through existing pipelines to tap the resources in the Caspian Sea have begun, and new pipelines through Georgia and Turkey are being constructed. This development means that many companies that signed the oil consortium are moving into the area, drastically increasing the presence of the Western world in the Gulf peninsula.

As oil consortium plans fall into place, the Azerbaijani-Armenian conflict over the Nagorno Karabakh region moves to Azerbaijan's political forefront. In order to facilitate pipeline construction through that region, Azerbaijan must have peaceful cooperation from Armenia. A cease-fire agreement is finally reached with Armenia, although scattered border clashes still occur.

Despite the peace accord with Armenia, Azerbaijan suffers from internal political instability, caught between former communist doctrines and its new 1995 constitution and independent ideals. The Pro-Government faction continues to hold the major political spot, while the Popular Front and National Independent Parties run a distant second. With no steady government history and varying political differences, Azerbaijani is wide open for foreign interference.

This intervention soon comes from neighboring Iran, which senses a prime opportunity to upset the political balance. With expansionism as a key objective, Iran covertly backs a Pro-Islamic coup against the Azerbaijan government. If Iran can topple the current political faction and disassemble the Azerbaijani Jihand Militia, it can both invade Azerbaijan and close in on the Karabakh region.

The second major move by Iran is to invade Armenia, a Christian country in alliance with NATO. Both Azerbaijan and Armenia border the oil-rich Caspian Sea, and Iran believes that by controlling both the source of the oil and its pipeline regions, it will effectively monopolize oil resources in the region.

As Iran's expansion threatens Gulf security, Armenia makes a plea to the United Nations for military assistance. Already alarmed by Iran's coup in Azerbaijan and the implementation of puppet leaders there, the United States is the first NATO country to respond. Three Corps and 1st Cavalry divisions are sent in to defend the Armenian-Azerbaijani border. Iran, in an attempt to take the area before it can be fully staffed with troops, makes an early attack on US forces from the east. This is the military scenario that opens Longbow 2.

DYNAMIC CAMPAIGN

Overview

At the heart of the campaign is the dynamic mission generator (DMG), which tracks all friendly and enemy units on the battlefield. This system keeps a running tally on what priority targets have been destroyed, how many friendly casualties have occurred, how many weapon and aircraft resources remain, and what areas have been secured. All of your actions during a mission affect the outcome, as well as everything that happens thereafter. And since the game campaign is centered around a set of limited weapon and helicopter resources, you must carefully choose what resources to expend in any given mission.

The DMG formulates a variety of mission types — strike, reconnaissance, close air support, combat air patrol, escort, special insertion and extraction procedures, and specialized targets. On any given day and in varying weather conditions, you may face a mix of target types that requires you to manage several mission types at once — close-air support in one sector, SAM seek-and-destroy in another, and recon intelligence in yet another.

Based on cumulative results from all missions, the DMG formulates successive missions (approximately one per day) that are based on your performance, not on a static set of data. Each generated mission has random elements as well, giving every mission the potential for surprise. This allows the campaign to unfold differently each time you play, producing a different theater with different conditions.

Campaign Goals

The goal of the campaign is to overtake a specific amount of territory by heading up offensive pushes against enemy lines. (See ***Criteria for an Offensive Advance****, p. 6.21.) At the same time, you must prevent the enemy from accomplishing the same goal. Your duties, all of which impact the success or failure of the campaign, can be summed up as follows:*

- Managing limited weapon and helicopter resources
- Destroying strategic enemy ground positions
- Attacking enemy supply convoys
- Escorting supply convoys to friendly forces
- Providing air support for friendly ground offensives
- Gather intelligence through reconnaissance missions
- Perform troop insertion and extraction
- Other duties generated by the force commanders as the campaign commences

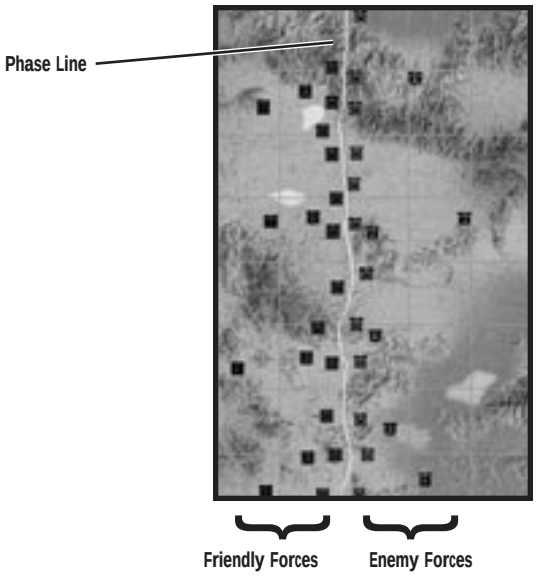
Real Success: The Ground War

The most important feature of the DMG system is that the flow of the campaign isn't just based on how many targets you destroy or how well you conserve firepower — it also depends heavily on the success and failure of the friendly ground forces you're supporting.

All ground forces have an independent artificial intelligence system and fight their own battles below. They're expecting you to help them accomplish their ground objectives on the ground and establish new battle lines. Each forward move they make occurs when you've fulfilled their battle needs, which you do by satisfying certain criteria. If friendly ground forces "defeat" enemy forces in a certain area, the front line —called a *phase line* — moves accordingly. The better your mission performance, the more likely your forces are to advance. If you do poorly, then they won't be as successful and may lose ground.

Example: During a mission, you're supposed to be escorting a supply convoy to friendly front lines. However, you detect an established enemy position and decide to break off for a quick air strike against the enemy's flank position. Meanwhile, the friendly ground forces on the front line take a beating because they're running low on ammunition, and the convoy is attacked.

The end result of this situation is that you may have destroyed a lot of potentially dangerous enemy targets, but the friendly ground offensive has ground to a halt. To initiate a new offensive in this area, you'll have to resupply the front lines and give the ground forces time to reassemble and push forward.



Criteria for an Offensive Advance

It is true that the ground forces depend on you for support. But before you're asked to provide Close Air Support to any advancing ground forces, you'll get several missions that will help ensure that they can transition into an offensive posture. These missions — mostly based on supplying front-line forces — help meet the following "advance" criteria:

(1) Supply. First, ground forces must have sufficient ammunition and/or fuel supplies. If the armor commander doesn't have enough resources to sustain an offensive move, the units will remain defensive and the battle line will not move. These precious supplies arrive in convoys, which you occasionally are asked to escort to safety. Similarly, whenever ground intelligence (through previous recon missions or other means) detects an enemy supply convoy, you'll be asked to destroy it to prevent the enemy from going on the offensive.

(2) Armor. Ground forces must also have ample armor – if armor resources are lacking, the unit will retain its defensive posture. Like resources, armor reinforcements arrive in convoys. (Supply convoys always take precedence over armor convoys, however — protect them first.)

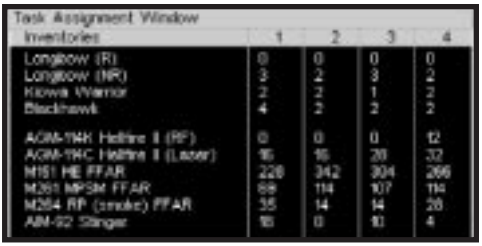
(3) Accessible Support. Finally, ground forces must have support in adjacent battle sectors. The armor commander on the ground (driven by the game's artificial intelligence system) does not like to overextend his troops in the flank position. If the flank is vulnerable, ground units will move into a defensive posture and wait for rear support.

What this means to you as a player is that great mission performances in one sector of the map doesn't guarantee victory. You should constantly monitor all sectors of the battlefield and ensure that your front-line units are all supplied and ready for an offensive push.

In summary, everything that you do does affect the campaign in the long run. Taking out SAM and AAA sites early on — even at the cost of losing some territory in the ground war — may easily help you support ground forces later. However, timing is critical, since ground forces cannot sustain an offensive push for very long. Once a friendly advance is halted, it may take several days before troops can gather enough strength to go on the offensive again.

One last note — even though you destroy enemy positions, they're receiving reinforcements as well. A SAM site you destroyed in one mission may be replaced later during the campaign.

Resource Management



During the campaign, you serve as the task force commander, both directing actions and allocating resources. Wise management of your helicopter and ordnance assets plays a large role in how successful you are in the campaign. You won't always be able to take the best weapons available — instead, you'll need to make careful assessments and informed decisions and carry the minimum ordnance needed to accomplish the mission. If you run out of Hellfires or Longbows, you're short until you can bring in more supplies.

These limited resources are stored at mobile Forward Air and Refueling Points (FARPs). FARPs are re-supplied with additional weapons and new helicopters on a regular basis, as long as you protect the arriving convoys.

Mission Outcomes

Each time you complete a campaign mission, the DMG sorts through the mission data and starts generating your next mission. The outcome of the previous mission isn't strictly rated as a success or failure — although you're credited for destroying key targets, other factors affect what happens, including friendly and enemy casualties , timing, mission planning and positioning.

In the end, the results of both the air war and ground wars modify the mission outcome. If you succeed in accomplishing the mission objectives, the battle lines are updated to reflect the newly captured territory. Eventually, if you keep advancing, you'll win.

The flow of the campaign is contingent on the movements of friendly ground forces. Your performance in the air can make their advance easier or harder, based on how well you've done in prior missions. Ultimately, however, the units on the ground are the only ones who can capture territory. When friendly ground forces have advanced to the campaign objective, your side wins the war.

Whatever the outcome, we hope you'll find the dynamic campaign to be an thoroughly enjoyable combat experience with infinite replay value. Holding true to the Jane's Combat Simulations motto of authenticity, *Longbow 2* strives to provide the most realistic combat you can find outside the smoke of an actual battlefield.

7
Specifications

7. SPECIFICATIONS

This section lists Jane's specifications for the major armament and avionic systems for flyable player helicopters in the game, as well as their major weapons and avionic components. These entries originate from the 1995-96 versions of *Jane's Air Launched Weapons, Jane's Avionics, Jane's Armour And Artillery Upgrades, Jane's Electro-Optic Systems* and *Jane's Infantry Weapons*. The Mast Mounted Radar entry comes from the 1996-97 edition of *Jane's Radar and Electronic Warfare Systems*. Some descriptions and/or statistics have been abridged due to space constraints.

Note: *Some specifications are not final and are subject to change throughout the development cycle.*

HELICOPTER	MAIN WEAPONS	PRIMARY AVIONICS
AH-64D Longbow Apache	M230 Chain Gun Cannon	Longbow Radar
	AIM-92 Stinger	Target Acquisition Designation Sight/Pilot Night Vision System
	Folding Fin Aerial Rocket	AN/ALQ-144 Infrared Countermeasures Set
	Hellfire Missile	AN/APR-39A Threat Warning System
		AN/AVR-2 Laser Detecting Set
OH-58D Kiowa Warrior	Global Helicopter Technology CFD-S000 pod with 7.62mm or .50 inch machine guns	MMS Mast Mounted Sight
		AN/AVR-2 Laser Detecting Set
	AIM-92 Stinger	AN/APR-39A Threat Warning System
	Folding Fin Aerial Rocket	AN/ALQ-144 Infrared Countermeasures Set
	Hellfire Missile	
UH-60A/L Black Hawk	M60D 7.62mm Machine Gun (door)	AN/APR-39A Threat Warning System
	M134 7.62mm Machine Gun (door)	AN/AVR-2 Laser Detecting Set
	Folding Fin Aerial Rocket	AN/ALQ-144 Infrared Countermeasures Set
	Hellfire Missile	

DEFINITIONS

The following specs are given for each entry, where appropriate and available.

Armament. For tanks and armoured vehicles, number and types of weapons mounted on vehicle.

ATGW. Anti-Tank Guided Weapon.

Body diameter. Of a missile, given in metres at the widest point.

Calibre. For artillery and guns, interior diameter of the barrel given in millimetres. For ammunition, designates which artillery the ammunition can be used with.

Combat radius. For aircraft, distance in nautical miles it can fly from base and retain enough fuel to return, when loaded as for a combat mission.

Effective range. For a radar system, the maximum distance at which a contact can be accurately detected, given in kilometres.

Field of view/field of regard. For sensors, the range of horizontal degrees (azumith or bearing) or vertical degrees (elevation) in which a sensor can effectively perform detection.

G limit. Structural limit to the gravity-force an aircraft is able to withstand.

Guidance. For missiles, the system used to guide it to target.

Height. For aircraft and ground vehicles, measured at highest point off the ground unless otherwise indicated, given in metres.

Hovering ceiling. For helicopters, maximum altitude in metres at which a hover can be maintained.

Launch weight. Of a missile, weight in kilograms prior to launch (propellant is consumed as the missile flies, reducing its weight).

Length. For aircraft, missiles or ground vehicles, measured in metres at longest point.

Max level speed. For aircraft, maximum attainable speed during level flight, given by Mach number (or in knots).

Max range. For aircraft, maximum distance (in nautical miles) flown without refueling. For missiles, maximum distance (in kilometres) at which target can be hit. For radar systems, maximum distance (in kilometres) at which a contact can be picked up. For ground vehicles, maximum distance (in kilometres) travelled without refuelling.

Max rate of climb. The fastest rate at which an aircraft is capable of gaining altitude, given in metres gained per minute.

Max speed. For missiles and vehicles, maximum attainable speed given in kilometres per hour.

Max T-O weight. Limit to which an aircraft can be loaded and still take off.

Min range. For missiles, minimum distance from target required for missile to effectively maneuver towards target, given in metres.

Nautical Miles (nm). A unit of distance fore sea and air navigation (1,852m).

Never-exceed speed (VNE). For aircraft, aerodynamic or structural speed limit in knots.

Propulsion. For missiles, method or material by which the missile is propelled.

Rate of fire. For artillery or armoured vehicles, number of rounds fired by gun per minute. Cyclic refers to number possible when feed belts are linked together in an unending chain, practical gives the normal belt length used.

Resolution. Number of screen pixels (horizonal/vertical dots on a display screen), such as 640 x 480.

Rotor diameter (each). For helicopters, diameter in metres of each main rotor.

Service ceiling. For aircraft, the altitude in metres at which maximum rate of climb is attained.

Warhead. For missiles, type of explosive material carried.

Wing span. For rotary-wing aircraft, diameter of rotor disk in metres (see also rotor diameter). For missiles, distance in metres from fin tip to fin tip at widest point.

MILITARY AIRCRAFT, ROTARY WING

AH-64D Longbow Apache

SECTION
Aircraft – Rotary-Wing – Military

COUNTRY
USA

TITLE
McDonnell Douglas Apache Upgrades for AH-64A, C and D (US Army); Petan or "Cobra" (Israel Defence Force).

TYPE
Day/night twin-engined attack helicopter upgrade.

PROGRAMME
Original Hughes Model 77 entered for US Army advanced attack helicopter (AAH) competition; first flights of two development prototype YAH-64s 30 September and 22 November 1975; selected by US Army December 1976; named Apache late 1981.

Deliveries started 26 January 1984; 700th delivered December 1991; 720 by April 1992; 811th and final for delivery December 1994; initial operating capability achieved by 3rd Squadron, 6th Cavalry Regiment, July 1986; 29 of 40 planned AH-64A battalions, including seven National Guard and two Army Reserve, combat-ready by December 1992; first combat use (11 AH-64As) in operation Just Cause, Panama, December 1989; used extensively (288) during January/February 1991 Gulf War against Iraq, including first air strike of conflict. First AH-64As issued to Army National Guard in 1987; fourth ArNG unit (I-211 AvRgt in Utah) established 1990; first overseas regiment 2/6 Cavalry Regiment, Illesheim, Germany, September 1987; eighth in Europe (3-4 AvRgt at Finthen) equipped 1990; battalion consists of 18 AH-64As and 13 Bell OH-58 Kiowas; more than 160 AH-64As based in Germany at peak strength, but force now reduced.

Eleven month programme to integrate air-to-air Stinger began October 1987; four missiles mounted in pairs on wingtips, five firings early 1989; air-to-air development programme included firing two AIM-9 Sidewinders in hover and at 80 knots (148 km/h; 92 mph) at White Sands, New Mexico, November 1987; laser ranging and tracking tests on Bell UH-1 and LTV A-7 flown in 1989; M-230 Chain Gun being improved for air-to-air use; Matra Mistral captive carry tests completed. New missile control system by Base 10 Defense of Trenton, New Jersey, used for two more Stinger firings during 1990; Sidearm anti-radiation missile from AH-64A hit RF emitter on armoured vehicle at US Naval Weapons Test Center 25 April 1988.

VARIANTS

AH-64A. Production for US Army and export. All to be upgraded to AH-64D; last in 2010. Retrofit from 1993 with Sincgars secure radios and GPS; first installed in Apaches of 5-501 Aviation Regiment on deployment to Camp Eagle, South Korea, from March 1994, as first AH-64s in Korea.

AH-64B. Cancelled in 1992. Was planned near-term upgrade of 254 AH-64s with improvements derived from operating experience in 1991 Gulf War, including GPS, Sincgars radios, target handover capability, better navigation, and improved reliability including new rotor blades.

AH-64C. Previous designation for upgrade of AH-64As to near AH-64D standard, apart from omission of Longbow radar retention of -701 engines; provisions for optional fitment of both; Army requested draft proposal, August 1991; funding for two prototype conversions awarded in September 1992. With exception of AH-64Ds and re-sales, all remaining US Army AH-64As (approximately 540) to be modified. Designation abandoned late 1993; all Apaches to become AH-64D, including those not fitted with radar.

AH-64D Longbow Apache. Current improvement programme based on Westinghouse mast-mounted Longbow millimetre-wave radar and Martin Marietta Hellfire with RF seeker; includes more powerful GE T700-GE-701C engines, larger generators for 70 kVA peak loads, Plessey AN/ASN-157 Doppler navigation, MIL-STD-1553B databus allied to dual 1750 A processors, and a vapour cycle cooling system for avionics; early user tests completed April 1990.

Full-scale development programme, lasting 51 months, authorised by Defense Acquisition Board August 1990, but airframe work extended in December 1990 to 70 months to coincide with missile development; supporting modifications being incorporated progressively; first flight of AH-64A (82-23356) with dummy Longbow radome 11 March 1991; first (89-0192) of four AH-64D prototypes flown 15 April 1992; second (89-0228) flew 13 November 1992; fitted with radar in mid-1993 and flown 20 August 1993; No.3 (90-0324) flown 30 June 1993; No.4 (85-25410) on 4 October 1993; No.5 (formerly AH-64C No.1) 19 January 1994 (first Apache with new Hamilton Standard lightweight flight management computer); No.6 4 March 1994; last two mentioned converted from 85-25408 and 85-25477. Six AH-64Ds to fly 3,300 hour test programme; production deliveries to start 1997 from planned first batch of 24.

Following redesignation of AH-64C in late 1993, entire Army inventory to be known as AH-64D Longbow Apache, although only 227 (original AH-64D total) to carry Longbow radar. AH-64D to equip 26 battalions; company strength to be three with radar plus five without; three companies per battalion. Longbow can track flying targets and see through rain, fog, and smoke that defeat FLIR and TV; RF Hellfire can operate at shorter ranges; it can lock-on before launch or launch on co-ordinates and lock-on in flight; Longbow scans through 360° for aerial targets or scans over 270° in 90° sectors for ground targets; mast-mounted rotating antenna weighs 113 kg (250lb).

Further modification include “manprint” cockpit with large displays, air-to-air missiles, digital autostabiliser, integrated GPS/Doppler/INS/air data/laser/radar altimeter navigation system, digitial communications, faster target handoff system, and enhanced fault detection with data transfer and recording. AH-64D No.1 made first Hellfire launch on 21 May 1993; first demonstration of digital air-to-ground data communications with Synmetrics Industries improved data modem, 8 December 1993.

SPECIFICATIONS

DIMENSIONS, EXTERNAL	
Main rotor diameter	14.63m
Length overall	
tail rotor turning	15.54m
both rotors turning	17.76m
Wing span	
clean	5.23m
empty weapon racks	5.82m
Height	
over tailfin	3.55m
over tail rotor	4.30m
to top of rotor head	3.84m
to top of air data sensor	4.66m
overall, AH-64D	4.95m

WEIGHTS AND LOADINGS	
Max T-O weight	
-701 engine	9,525kg
-701C engine, ferry mission, full fuel	10,107kg

PERFORMANCE	
Max level and max cruising speed	
A	158 knots
L	141 knots
Max rate of climb at S/L	
B	990m
L	942m
Cruising speed at intermediate rated power	
C	147 kts
D	148 knots
F	150 knots
B	151 knots
E, H	153 knots
A	154 knots
G	155 knots
Max vertical rate of climb at S/L:	
A	762m
B	771m
L	474m
Service ceiling	
A	6,400m
Service ceiling, OEI	
A	3,290m
B	3,800m
Hovering ceiling	
IGE A	4,570m
IGE B	5,245m
IGE L	4,115m
OGE A	3,505m
OGE B	4,125m
OGE L	2,990m
Max range, internal fuel (30 min reserves)	
A	260nm
B	220nm
L	220nm
Ferry range, max internal and external fuel, still air, 45 min reserves	1,024nm
Endurance at 1,220m at 35°C	1 h 50 min
Max endurance, internal fuel	3 h 9 min
G limits 164 knots	+3.5/-0.5

Max vertical rate of climb at intermediate rated power	
B, C	137m
H	238m
F, G	262m
E	293m
D	301m
A	448m

UH-60A/L Black Hawk (Sikorsky S-70A)

PUBLICATION
Jane's All The World's Aircraft 1995-96

SECTION
Aircraft – Rotary Wing – Military

COUNTRY
USA

COMPANY
Sikorsky

TITLE
Sikorsky S-70A

DESIGNATIONS
UH-60A, UH-60L and UH-60Q Black Hawk, AH-60L, EH-60A, MH-60A, MH-60K and MH-60L (US Army); UH-60A, HH-60G, MH-60G Pave Hawk (US Air Force); VH-60N (US Marine Corps); Yanshuf (Owl) (Israel Defence Force).

TYPE
Infantry squad transport helicopter; also adapted for other roles.

VARIANTS
UH-60A Black Hawk. Initial production version, designed to carry crew of three and 11 troops; also can be used without modification for medevac, reconnaissance, command and control, and troop supply; cargo hook capacity 3630kg; one UH-60A can be carried in C-130, two in C-141 and six in C-5.

Medevac kits delivered from 1981; missile qualification completed June 1987, with day and night firing of Hellfire in various flight conditions; airborne target handover system (ATHS) qualified; cockpit lighting suitable for night vision goggles fitted to production UH-60s since November 1985 and retrofitted to those built earlier. Total 1,049 built for US Army (including 66 conversions to EH-60A) before production change to UH-60L in 1989. Detailed description applies to UH-60A/L except where indicated.

Enhanced Black Hawk. Incorporates active and passive self-defence systems; retrofitted by Corpus Christi Army Depot, Texas, to new build UH-60A/Ls; first 15 delivered to US Army in South Korea November 1989. Equipment includes Tracor AN/ARN-148 Omega navigation receiver, Motorola AN/LST-5B satellite UHF communications transceiver, Bendix/King AN/ARC-199 HF-SSB, and AEL AN/APR-44(V)3 specific threat RWR complementing existing AN/APR-39 general threat RWR; M134 Minigun can be fitted on each of two pintle mounts, replacing M60 machine-gun.

UH-60L. Replaced UH-60A in production for US Army from October 1989 (aircraft 89-26179 onwards); prototype (84-23953) first flight 22 March 1988; first delivery 7 November 1989 to Texas ArNG. Powered by T700-GE-701C engines with uprated 2535 kW transmission. Current production aircraft fitted with hover infrared suppression system (HIRSS) to cool exhaust in hover as well as forward flight; older UH-60s retrofitted. Composites wide-chord main rotor blades of improved design flight tested at West Palm Beach, beginning 8 December 1993; projected retrofit from 1997.

DESIGN FEATURES

Represented new generation in technology for performance, survivability and ease of operation when introduced to replace UH-1 as US Army's main squad-carrying helicopter; Four-blade main rotor; one-piece forged titanium rotor head with elastomeric blade retention bearings providing all movement and requiring no lubrication; hydraulic drag dampers; bifilar self-tuning vibration absorber above head; blades have 18° twist, and tips swept at 20°; thickness and camber vary over the length of blades, based on Sikorsky SC-1095 aerofoil; blades tolerant up to 23mm hits and spar tubes pressurised with gauges to indicate loss of pressure following structural degradation.

Two pairs of tail rotor blades fastened in cross-beam arrangement, mounted to starboard; tail rotor pylon tilted to port to produce lift as well as anti-torque thrust and to extend permissible CG range; fixed fin large enough to allow controlled run-on landing following loss of tail rotor.

AVIONICS

Configurations vary between aircraft, particularly on HH/MH-60G versions. Additional avionics and self-protection equipment installed in Enhanced Black Hawk, as described under Current Versions.

Comms. E-Systems AN/ARC-186 VHF-FM, GTE Sylvania AN/ARC-115 VHF-AM, Magnavox AN/ARC-164 UHF-AM, Collins AN/ARC-186(V) VHF-AM/FM, Bendix/King AN/APX-100 IFF transponder, Magnavox TSEC/KT-28 voice security set, and intercom. HH/MH-60G has AN/URC-108 Satcom.

Radar. MH-60K has Texas Instruments AN/APQ-147A terrain-following/terrain-avoidance radar, HH/MH-60G has Bendix/King AN/APN-239 (RDR-1400C) radar. AH-60L and some export S-70s also equipped with radar.

Flight. Hamilton Standard AFCS with digital three-axis autopilot, Bendix/King AN/ARN-123(V)1 VOR/marker beacon/glide slope receiver, Emerson AN/ARN-89 ADF, Honeywell Plessey Electronic Systems AN/ASN-128 Doppler, AN/ASN-43 gyrocompass, Honeywell AN/APN-209(V)2 radar altimeter. HH/MH-60G has GEC-Marconi AN/ASN-137 Doppler, Rockwell Collins AN/ASN-149 GPS and Litton ring laser gyro INS (replacing Carousel IV).

Instrumentation. HH/MH-60G has Teldix KG-10 map display.

Mission. HH/MH-60G has Hughes AN/AAQ-16 FLIR.

Self-defence. Baseline UH-60 Black Hawk has E-Systems Melpar/Memcor AN/APR-39(V)1 RWR, Sanders AN/ALQ-144 IR countermeasures set and Tracor M-130 chaff/flare dispenser. MH-60K has Honeywell AN/AAR-47 missile warning system, Northrop Grumman AN/ALQ-136 pulse radio frequency jammer, Northrop Grumman AN/ALQ-162 CW radio jammer, E-Systems AN/APR-39A and AN/APR-44 pulse/CW warning receivers, Perkin-Elmer AN/AVR-2 laser detector, Tracor M-130 chaff/flare dispenser and Sanders AN/ALQ-144 IR countermeasures set.

ARMAMENT

New production UH-60A/Lincorporate hardpoints for an external stores support system (ESSS). This consists of a combination of fixed provisions built into the airframe and four removable external pylons from which fuel tanks and a variety of weapons can be suspended.

SPECIFICATIONS

DIMENSIONS, EXTERNAL	
Main rotor diameter	*16.36m*
Length overall	
rotors turning	19.76m
rotors and tail pylon folded	12.60m
Height	
overall, tail rotor turning	5.13m
to top of rotor head	3.76m
in air-transportable configuration	2.67m

WEIGHTS AND LOADING	
Mission T-O weight	
UH-60A	7,484kg
UH-60L	7,711kg
HH-60G	8,119kg
MH-60K	11,113kg

PERFORMANCE	
Max level speed at S/L	160 knots
Max level speed at max T-O weight	58 knots
Max cruising speed	
UH-60A	139 knots
UH-60L	150 knots
Vertical rate of climb at 1,220m and 35˚C (95˚F)	
UH-60A	125m
UH-60L	239m
Service ceiling	5,790m
Hovering ceiling	
IGE at 35˚	2,895m
OGE, ISA	3,170m
OGE at 35˚C	1,705m
Range with max internal fuel at max T-O weight, 30 min reserves	
UH-60A	319nm
UH-60L	315nm
Range with external fuel tanks on ESSS pylons with two 870 litre tanks	880nm
Range E with two 870 litre and two 1,703 litre tanks	1,200nm
Endurance	
UH-60A	2 h 18 min
UH-60L	2 h 6 min
MH-60G with max fuel	4 h 51 min

OH-58D Kiowa Warrior

PUBLICATION
Aircraft – Rotary-Wing – Military

COUNTRY
USA

COMPANY
Bell

TITLE
Bell 406 (AHIP)

DESIGNATIONS
OH-58D Kiowa and Kiowa Warrior (US Army).

TYPE
Two-seat scout and attack helicopter.

VARIANTS
Prime Chance. Fifteen special armed OH-58Ds (86-8908 to -8922) modified from September 1987 under Operation Prime Chance for use against Iranian high-speed boats in Gulf; delivery started after 98 days, in December 1987; firing clearance for Stinger, Hellfire, 0.50 in gun and seven-tube rocket pods completed in seven days. Further conversion (85-24716) for development trials. All currently operated by 4-17th Cavalry at Fort Bragg, North Carolina.

Kiowa Warrior. Armed version, to which all planned OH-58Ds are being modified; integrated weapons pylons, uprated transmission and engine, lateral CG limits increased, raised gross weight, EMV protection of avionics bays, localised strengthening, RWR, IR jammer, video recorder, SINCGARS radios, laser warning receiver and tilted vertical fin; armament same as Prime Chance; integrated avionics and lightened structure. converted aircraft (of which 89-0090 was first) reportedly have since reverted to standard, but low-observable OH-58Ds of 1-17th Cavalry at Fort Bragg, North Carolina, operating with undisclosed modifications by 1993; changes include coated rotor blades, new windscreen material and modified rotor sail, rotor cuffs and hubs for substantial reduction in frontal radar signature.

Further modifications for Warrior, currently under consideration, include undernose FLIR turret (tested late 1993); 227 litre conformal fuel tanks on flanks of rear cabin; radio frequency interferometer RWR; INS/GPS; digital map display; integrated helmet display; and 19.5 percent power plant uprating for OGE hover at 1220m at 35°C with four Hellfire ATMs.

OH-58X Light Utility Variant. Contender for anticipated US Army requirement; fourth development OH-58D (69-16322) modified in 1992 with partial stealth features (including chisel nose).

DESIGN FEATURES

Four-blade Bell soft in plane rotor with carbon composites yoke, elastomeric bearings and composites blades. Main rotor rpm 395; tail rotor rpm 2381. McDonnell Douglas/Northrop Grumman mast-mounted sight containing TV and IR optics and laser designator/ranger; Honeywell integrated control of mission functions, navigation, communications, systems and maintenance functions based on large electronic primary displays for pilot and observer/gunner; hands-on cyclic and collective controls for all combat functions; automatic target hand-off system in some OH-58Ds operates air-to-air as well as air-to-ground using digital frequency hopping; system indicates location and armament state of other helicopters; some OH-58Ds have real-time video downlink capable of relaying to US Army Guardrail aircraft, to headquarters 22 nm away or, via satellite, to remote locations.

AVIONICS

Comms. Five com transceivers, datalink and secure voice equipment. Phase 1 additions, introduced on production line in 1990 in preparation for Kiowa Warrior, include AN/ARC-201 SINCGARS secure voice/data radio and Have Quick II radio.

Flight. Plessey (PESC) AN/ASN-157 Doppler strapdown INS.

Instrumentation. Equipped for day/night VFR. Multifunction displays for vertical and horizontal situation indication, mast-mounted sight day/night viewing and communications control, with selection via control column handgrip switches.

Mission. Mast-mounted sight houses 12x magnification TV camera, autofocusing IR thermal imaging sensor and laser rangefinder/designator, with automatic target tracking and in-flight automatic boresighting; turret may be trained 190° port and 190° starboard in azimuth; +-30° in elevation. Night vision goggles; AHRS; and airborne target handoff subsystem (ATHS). Germany-based OH-58Ds have real-time video downlink which can be relayed via Guardrail-capable aircraft. Phase 1 additions include doubled computer capacity to 88 kbits, added weapons selection/aiming and multitarget acquisition/track displays, video recorder, data transfer system, ANVIS display and symbology system and EMV hardening.

Self-defence. AN/APR-39(V)1 or -39A(V)1 RWR. Phase 1 adds AN/ALQ-144 IR jammer, second RWR (AN/APR-44(V)3) and AN/AVR-2 laser detection system.

ARMAMENT

Four Stinger air-to-air or Hellfire air-to-surface missiles, or two seven-round 2.75 in rocket pods, or one Global Helicopter Technology CFD-5000 pod for 7.62mm and 0.50 in machine-guns, mounted on outriggers on cabin sides (port side only for gun). IR jammer standard on armed version.

SPECIFICATIONS

DIMENSIONS, EXTERNAL	
Main rotor diameter	10.67m
Length	
overall, rotors turning	12.85m
fuselage (pitot to skid)	10.48m
fin tilted for air transport	10.29m
Height	
overall	3.93m
for air transport (MPLH)	2.73m

WEIGHTS AND LOADINGS	
Max T-O and landing weight	
K	2,041kg
KW	2,495kg

WEIGHTS AND LOADINGS	
Max level speed at 1,220m	*128 knots*
K	118 knots
KW	114 knots
Max rate of climb	
at S/L, ISA	469 m
at 1,220m, 35˚C (95˚F)	over 366m/min

Vertical rate of climb		
at S/L, ISA		
K		232m/min
KW		4,875m/min
at 1,220m, 35˚C (95˚F)		
K		over 152m/min
Service ceiling, KW		4,575m
Hovering ceiling		
IGE, ISA	K	over 3,660m
	KW	3,050m
OGE, ISA	K	3,415m
	KW	2,105m
OGE, 35˚C (95˚F)	K	1,735m
	KW*	1,220m
Range		
K		250nm
KW		223 nm
Endurance: K and KW		2 h 24 min

WEAPONRY

AIM-92 Stinger

PUBLICATION
Jane's Air Launched Weapons 1995-96

SECTION
Air-To-Air Missiles

TITLE
AIM-92 Stinger

TYPE
Short range IR air-to-air missile

COMPANIES
Hughes Missile Systems, (prime contractor) Raytheon, Bedford, Massachusetts (second source)

DEVELOPMENT
The Air-To-Air Stinger (ATAS) programme provides a sensitive lightweight IR missile for use at short range against low flying aircraft and helicopter targets. Stinger improvements include Stinger Post and Stinger RMP, the former incorporating a dual colour IR and UV seeker for decoy discrimination and the latter a reprogrammable microprocessor. Hughes developed a dual mode seeker for Stinger, adding a passive radar seeker to the existing IR/UV seeker, in a version known as Air Defence Suppression Missile (ADSM).

DESCRIPTION
The ATAS system consists of the FIM-92 Stinger missile, a launcher with launcher electronics, launcher adaptor, coolant reservoir, interface electronics unit and the fire control and aiming system. The most common helicopter launcher in use is the two missile, lightweight, stackable, quick reload launcher. The FIM-92 Stinger missile is a short-range infra-red homing missile powered by a solid propellant motor and armed with a fragmentation warhead. For the current ATAS system, the early Stinger guidance seekers are believed to have all been replaced by the later Stinger Passive Optical Seeker Technology (POST) and Reprogrammable MicroProcessor (RMP) seekers.

SPECIFICATIONS

Length	*1.52m*	Warhead	*3kg HE blast fragmentation fuze*
Body diameter	*70mm*	Impact Guidance	*IR*
Wingspan	*0.14m*	Propulsion	*Solid propellant*
Launch weight	*16kg*	Range	*3km*

Folding Fin Aerial Rocket

PUBLICATION
Jane's Air Launched Weapons 1995-96

SECTION
Air-Launched Rockets

TITLE
Hydra 70 Rocket System (FFARs)

TYPE
70mm unguided aircraft rockets

COMPANY
BEI Defense Systems Company, Euless, Texas (prime contractor).

DEVELOPMENT
By far the most common aircraft launched rockets used by the United States armed forces are the 70mm (2.75in) which over the years have been manufactured by various companies to almost a common design. These have all descended from the original Mickey Mouse air-to-air rockets of 1948, and unusually employed eight flick-out tail fins for in-flight stability. Two of the earliest versions of the US designed 70mm rockets, which were used during the Vietnam war and exported throughout the Western world, were the Mk 4 and Mk 40, intended for use by high performance fixed-wing aircraft and helicopters respectively. These, with their numerous types of warhead, became known as the FFAR (Folding Fin Aerial Rocket) family of rockets because of their folding fins and are still in service to date.

At the 1992 Farnborough Air Show BEI announced it was developing three new warheads: two marker types for use by the USN, one as a battlefield smoke marker and the other consisting of smoke, chaff and flare; the third one is a multi-mission, Kinetic Energy (KE) penetrator warhead containing 14 sub-rockets. This warhead has application to anti-armour, anti-material, anti-air and anti-coastal shipping missions. At the time of the announcement these warheads had not been allocated a designated number and were known as: MXXX Orange Smoke Marker Warhead, Multimode Marker Warhead and the 70mm Shot Rocket Warhead.

DESCRIPTION
The Hydra 70 rocket has the appearance of a conventional 70mm diameter unguided rocket comprising a Mk 66 solid propellant motor with three wraparound aluminium folding fins and an appropriate warhead with fuze.

The range of warheads that can be fitted to the Mk 66 motor includes flechette, high explosive, multipurpose submunition, smoke, flare and practice type. Listed below are several that are known to be in current use:

(a) The M151 HE is an anti-personnel, anti-material high explosive warhead made of modular maleable cast iron.On detonation the warhead bursts into thousands of small, high velocity fragments.

(b) The M255 is a flechette warhead designed for air-to-air, air-to-surface, surface-to-air, and surface-to-surface applications.The flechettes are explosively discharged by a base-mounted fuze-ignited expulsion charge after motor burn out by a M422 fuze or a manually/automatically remote set M439 fuze.

(c) The M261 MPSM (MultiPurpose SubMunition) warhead consists of an a luminium case, plastic nose cone, expulsion charge and contains nine M73 HE shaped charge grenades for anti-personnel, anti-material, and anti-armour missions.

(d) The M262 Illumination Flare provides reliable stand-off battlefield illuminations.Optimum flare deployment altitude is 550m and the flare has a 120 seconds burn time giving 1 million candle power which provides a surface illumination of 0.5 lux over a 1.6km area.

(e) The M264 RP is a smoke warhead that is 0.68m long and weighs 4.0kg. The warhead case contains 72 red phosphorus ejected by either remote set or motor burn out fuzes. On ejection the immediately begin to produce a high density, non-toxic persistent smoke-screen.

(f) The M274 Signature Practice Warhead is used for training purposes. The warhead shell contains a low energy pyrotechnic charge that functions upon impact emitting a flash/bang and cloud of white smoke. It may be used for day or night training on live fire or electronic instrumented ranges and is visible up to 8km.

The MXXX Orange Marker and the MXXX Multimode Marker warheads that BEI announced in 1992 are both designed to be propelled by the Mk 66 motor and may utilise M439 remote set or M442/M446 motor burn out fuzing.The MXXX Multimode Marker contains a hot smoke, chaff and pulsating flare payload. On ejection from the warhead, a hot smoke is formed, interspersed with puffs of chaff. The flare falls directly to earth and brightly pulsates. These features emit signatures in visual, infra-red and radar wavelengths, permitting day or night target marking that can be acquired by a wide variety of attack aircraft sensors.

Finally the MXXX Shot Rocket Warhead has been developed by BEI in conjunction with Universal Propulsion Company

SPECIFICATIONS

Length	1.06m (less warhead)	*Launch weight*	6.2kg
Body diameter	70mm	*Warhead*	mainly 4.5kg class
Tailspan	186m		

Hellfire Missile

PUBLICATION
Jane's Armour And Artillery Upgrades 1995-96

SECTION
Vehicle-Mounted Anti-Tank Guided Weapons

TITLE
Rockwell Hellfire Modular Missile System

COMPANIES
Rockwell International, Tactical Systems Division Martin Marietta Orlando Aerospace.

DESCRIPTION
The AGM-114 Hellfire modular multipurpose missile system is currently in service in several semi-active laser guided configurations with the US armed forces and several other nations. The fielded missile has a minimum range of 500m and a maximum range of 5000 to 8000m.Hellfire was originally developed as the main weapon for the McDonnell Douglas AH-64 Apache attack helicopter, the SAL guidance being matched to its tactical employment concepts as both it and the OH-58D/AHIP scout helicopter each have Hellfire compatible lasers. The available engagement options are called the auto-nomous engagement mode and the co-operative engagement mode, depending upon whether the launch platform or the scout marks the target. The term "remote lasing" is synonymous with the co-operative engagement mode.

Hellfire uses pulse coded laser illumination at the 1.06 æm wavelength so that the missile will only lock on to what it is supposed to. As a result, Hellfire can be fired before a lock on has been achieved, with target acquisition being achieved in flight. Alternatively, it can be inhibited from igniting its motor until after a lock on has been achieved.

The Hellfire is currently fielded in the following versions:

(a) AGM-114A – first production model

(b) AGM-114B – US Marine Corps Hellfire with Improved Low Visibility (ILV) autopilot for low visibility conditions; minimum smoke rocket motor; ship-board-qualified Safe and Arm Device (SAD) for rocket motor

(c) AGM-114C – same as AGM-114B except without USMC SAD unit

(d) AGM-114F – same as AGM-114C except fitted with a precursor warhead charge to provide tandem warhead configuration

(e) Anti-ship Hellfire – a model C fitted with an anti-ship penetrating blast fragmentation warhead plus some slight autopilot modifications.

(f) AGM-114K Hellfire II – US Army and Marine Corps version with digital autopilot, improved semi-active laser seeker (that is, hardened against electro-optical jammers) and tandem warhead designed to defeat explosive reactive armour. The main 178 mm shaped charge warhead is similar to earlier models but has a different primary ignition charge to cater for the Magnavox electronic safety and arming unit. The comparatively large 100 mm precursor warhead is fitted with a molybdenum liner.

Hellfire was originally developed by the US Army to destroy MBTs. One of the requirements, though, was to hit manoeuvring targets at up to 20° to the right or left of the launch azimuth at distances of up to 1000m from the firing platform. This meant that Hellfire had to be designed with manoeuvrability features normally seen in anti-aircraft weapons rather than anti-tank missiles. At the same time the warhead was required to provide adequate margins of lethality against all forms of evolving armour. The result is a multiple purpose weapon capable of destroying virtually all tactical point targets from manoeuvring helicopters to MBTs to fixed installations.

There are also two millimetre wave radar seekers in development or about to begin development: the Longbow and the Brimstone configurations. It is envisaged that the AGM-114 Longbow Hellfire with its active millimetric-wave seeker will be the next production example for use with AH-64D Apache helicopters.

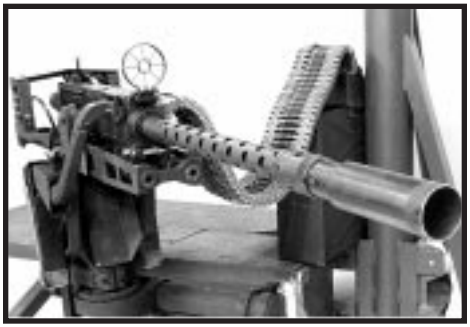
SPECIFICATIONS

Type	multiple purpose with semi-active lasing homing seeker
Warhead	HE unitary shaped charge (AGM-114A/B/C)

	AGM-114A/B/C	**IIR**
Length	1.626m	1.778m
Diameter	0.178m	0.178m
Wing span	0.33m	0.33m
Launch weight	45.7kg	47.88kg
Range	1500-8000m	n/av
Speed	Mach 1.4	n/av

FN 0.50 Browning M2 Heavy Barrel Machine Gun

Note: *This gun has recently been adapted for airborne use on helicopters. Specifications do not yet exist for the helicopter-mounted version.*



PUBLICATION
Jane's Infantry Weapons 1995-96

SECTION
Machine Guns

COUNTRY
Belgium

TITLE
FN 0.50 Browning M2 heavy barrel machine gun

DESCRIPTION
The FN 0.50 M2HB Browning machine gun is similar in design and operation to other types of Browning M2 machine gun, being a recoil-operated, air-cooled, belt-fed weapon. The mechanism operates in exactly the same manner as other Browning M2HBs so reference should be made to the appropriate entry under United States of America.

FN also produce various mountings for the M2HB, including the universal M3 tripod and the anti-aircraft M63 mounting.

TITLE
FN M3M, M3P and M3 L/S; FN 0.50 M2HB/QCB machine gun

DESCRIPTION
The above two guns are aircraft or helicopter versions of the FN 0.50 M2HB, the M3M for aircraft door mount applications, the M3P for pods (automatic only), and the M3 L/S for pintle mountings, with a light barrel and automatic firing only.

SPECIFICATIONS

Cartridge	.050 Browning (12.7 x 99mm)
Length	1.656m
Weight	38.15kg empty
Barrel	1.143m; rifling 1.064m
Rate of fire	cyclic, 450-550 rds/min
Muzzle velocity	916m/s with M33 ball
Max range	6765m
Effective range	+1500m

M134 7.62mm Minigun Machine Gun

PUBLICATION
Jane's Infantry Weapons 1995-96

SECTION
Machine Guns

TITLE
7.62mm M134 Minigun machine gun

DESCRIPTION
The 7.62mm M134 Minigun machine gun is based on the Gatling gun principle in which a high rate of fire is achieved by having a number of rotating barrels which fire in turn when the 12 o'clock position is reached. The Minigun is driven by a 28 V DC or 115 V AC electric motor and produces a steady rate of fire which varies according to type from between 2000 and 6000 rds/min as a top rate, down to 300 rds/min as the slowest rate of fire.

Six 7.62mm barrels fit into the rotor assembly and each is locked by a 180° turn. The gun housing is a one-piece casting holding the rotor assembly and providing a mounting for the "safety sector" and the guide bar. There is an elliptical cam path on the inner surface in which the bolt bearing roller runs. The rotor assembly is the main structural component of the gun and is supported in the gun housing by ball bearings.

Ammunition boxes carry a normal load of 4000 linked rounds. Since the entire gun is driven by an external source, a misfired round is simply ejected and thrown down the large section hose with the empties either into a box or, more usually, out over the side.

SPECIFICATIONS

Cartridge	7.62 x 51mm
No. of Barrels	6 (559mm)
Length	801.6mm overall
Weight	16.3kg
Sights	vary with employment
Rate of fire	up to 6000 rds/min
Muzzle velocity	869m/s

M230 Chain Gun Cannon

PUBLICATION
Jane's Air Launched Weapons 1995-96

SECTION
Guns, Pods And Mountings

PUBLICATION
Jane's Avionics 1995-96

SECTION
Electro-Optics

TITLE
M230 Chain Cannon – AH-64A Apache Helicopter Armament System

TYPE
30mm chain cannon for aircraft

COMPANY
McDonnell Douglas Helicopter Company, Mesa (prime contractor)

DEVELOPMENT
In early 1972, Hughes Helicopters, now McDonnell Douglas Helicopters Company (MDHC) began an independent research and development programme to manufacture a new 20mm single barrel, externally powered cannon. The new cannon was designed to use a simple closed loop chain drive system and to fire the US Army's existing M50 ammunition.

However, in the meantime, the US Army issued an RFP for development of the Advanced Attack Helicopter (AAH) and specified a requirement for a 30mm gun system chambered to fire the HEDP (High Explosive Dual Purpose) round.The M230 entered service with the US Army with the first production Apache helicopter in 1984.

DESCRIPTION
The M230 is a single-barrelled, electrically powered 30mm weapon that can fire either linked or linkless ammunition. In the AH-64A Apache installation, the cannon is mounted on a cradle-like turret beneath the fuselage, rather than in an enclosed turret at the front of the aircraft. Sighting is via the Integrated Helmet and Display Sight System (IHDSS) or the Target Acquisition and Designation System (TADS).

SPECIFICATIONS

Calibre	30mm	*Weight*	57.5kg
No.of barrels	1	*Rate of fire*	625 ± 25 rds/min
Length	1.68m	*Muzzle velocity*	805m/s

M60D 7.62mm Machine Gun

PUBLICATION
Jane's Air Launched Weapons 1995-96

SECTION
Guns, Pods And Mountings

COUNTRY
United States Of America

TITLE
M60D 7.62mm Machine Gun

TYPE
7.62mm machine gun.

DEVELOPMENT
The M60 family 7.62mm machine guns were originally developed in the late 1940s. They were originally designed for use by ground forces, as a lightweight machine gun that could be adapted for several uses.

A helicopter version was developed and designated M60D, with aircraft type ringsights, spade grips and an improved feed system. Several helicopter armament systems were developed for use with the M60D. These include the M16, M23, M41 and M59 systems; these have been cleared for use on several helicopters including the CH-47 Chinook, H-76 Eagle, SH-2 Seasprite, UH-1 Huey, and UH-60 Black Hawk.

DESCRIPTION
The M60D is a single-barrelled, gas-operated, air-cooled, belt-fed machine gun using disintegrating 7.62mm link ammunition. It employs a ringsight at the rear to improve its target acquisition and tracking ability when used from a relatively fast moving helicopter platform.

The gun, can be used with several helicopter armament systems, is 1.14 m long. It uses standard 7.62mm NATO ammunition: M61 AP, M62 tracer, M72 dummy, M80 ball and M82 blank.

SPECIFICATIONS

Cartridge	7.62mm	*Weight*	10.50kg
No. of Barrels	1	*Rate of fire*	500-650 rds/min
Length	1.14m	*Muzzle velocity*	853m/s

AVIONICS

AN/ALQ-144 Infrared Countermeasures Set

PUBLICATION
Jane's Avionics 1995-96

SECTION
Electronic Warfare

TITLE
Airborne IRCM system

COMPANY
Lockheed Sanders Inc.

DESCRIPTION

The AN/ALQ-144 is an electrically powered ICRM (infra-red countermeasures) set which provides medium-sized helicopters and small fixed-wing aircraft with protection against heat-seeking missiles.

It is an omnidirectional system consisting of a cylindrical source surrounded by a highly efficient modulation system to confuse the seeker of the incoming missile.

A number of variants are available; the AN/ALQ-144(V)1, ALQ-144(V)3, the AN/ALQ(VE) export version and the ALQ-144A (VP) Phase Lock pair. The electrically heated graphite source has extremely long life and the complete set weighs less than 14kg.

OPERATIONAL STATUS

As of this edition, AN/ALQ-144(v) 1/3 were reported to be in service with the US Army, Air Force and Marine Corps. The AN/ALQ-144(VE) has been sold to a number of other countries. The AN/ALQ-144(VP) has been used on the SH-60, H-3 and SH-2 aircraft of the US Navy.

Over 3,000 ALQ-144s protect a wide variety of helicopters and small fixed-wing aircraft of the US Navy, Army and Air Force.

SPECIFICATIONS

DIMENSIONS	
transmitter	241 x 251 x 336mm
Weight	
transmitter	12.7kg
control unit	0.5kg
Power supply	28 V DC, 1200-2000 W
Coverage	360° azimuth
Reliability	480 h MTBF

AN/APR-39A Threat Warning System

PUBLICATION
Jane's Avionics 1995-96

SECTION
Electronic Warfare

TITLE
AN/APR-39A Threat Warning Sytem

TYPE
Airborne and shipboard radar warning system for helicopters, light fixed-wing aircraft and naval vessels.

COMPANY
Loral Electronic Systems, Yonkers, New York.

DESCRIPTION (V)1
The AN/APR-39A(V)1 is an upgrade of the earlier analogue AN/APR-39(V)1 radar warning system. It is a lightweight system designed for helicopters and light fixed-wing aircraft, in particular those flying low level or nap-of-the-Earth missions. It provides visual and aural warning of hostile radar energy incident on the host aircraft over a very wide frequency range.

The digital display clearly identifies the threat type and azimuth from the aircraft. It also indicates if the threat is searching or locked and tracking, and when the radar lock is broken. The aural warning is by synthetic voice, such as "Missile ... 5 o'clock and tracking."

DESCRIPTION (V)2
The AN/APR-39A(V)2 is an advanced version of the APR-39A designed specifically for use on the US Army Special Electronic Mission Aircraft (SEMA), US Navy HH-60H helicopters, and for all US Marine Corps helicopters and C-130 aircraft.

DESCRIPTION (V)3
The AN/APR-39A(V)3 uses APR-39A(V)1 technology and provides continuous coverage through dual channel crystal video receivers. This system is deployed on US Army and NATO aircraft. It is specifically designed for helicopters and other light aircraft operating at very low levels.

SPECIFICATIONS

Frequency Range	
APR-39A(V)1	E to M and C/D
APR-39A(V)2	E to K and C/D Display: Bright light, NVG compatible
Weight	
APR-39A(V)1	7kg
APR-39A(V)2	13.6kg

AN/AVR-2 Laser Detecting Set

PUBLICATION
Jane's Radar And Electronic Warfare Systems 1995-96

SECTION
Airborne ECM Systems

COUNTRY
United States of America

TITLE
AN/AVR-2 Laser Detecting Set

TYPE
Airborne laser detecting set.

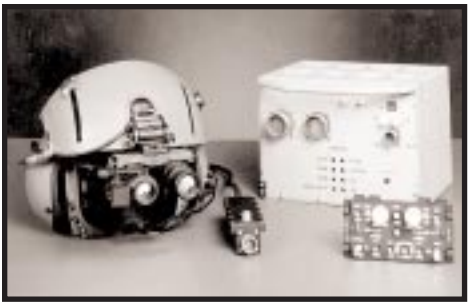
DESCRIPTION
The AN/AVR-2 laser detecting set detects, identifies and characterises optical signals over 360° around the aircraft, and provides warning and identification of laser threats to the crew. It consists of four SU-130/AVR-2 sensor units and a CM-493/AVR-2 interface unit comparator. The AVR-2 set interfaces with all variants of the AN/APR-39(V) series radar signal detecting set to function as an integrated radar and laser warning receiver system.

STATUS
In operational service with US Army and US Marine aircraft. The company is also developing laser warning systems for high-speed aircraft and combat vehicles. In February 1990 a multi-year contract was awarded and the units are now in production. Hughes Danbury has carried out an upgrade programme to convert the AVR-2 to AVR-2A configuration, under contract to the US Army, with deliveries commencing in mid-1993. As at mid-1994 approximately 500 sets had been delivered to the US Army with a further 1300 plus under contract. It is a mandatory requirement for the AH-1F, AH-1W, AH-64(2A), HH-60H, MH-47E(2A), MH-60K(2A), OH-58D(2A), UH-1N and UH-60Q(2A). The system is also planned for the RAH-66, SH-60B, SH-60F and the V-22.

The AVR-2 sensor head has also been reconfigured into a single optical head package for evaluation on an M1 Abrams tank.

COMPANY NAME
Hughes Aerospace and Electronics Company ADDRESS Danbury, Connecticut.

ANVIS/HUD System



PUBLICATION
Jane's Avionics 1995-96

SECTION
Head-Up Displays And Weapon Aiming Sights

COUNTRY
United States Of America

TITLE
ANVIS/HUD System

DESCRIPTION
The ANVIS/HUD system displays flight critical and advisory information collimated with the external view through the night vision goggles, eliminating the necessity for looking inside the cockpit. It is easily mounted on NVGs and does not interfere with the NVG image. Display quality is compatible with second- and third-generation AVS-6 goggles. The high-resolution/high-brightness display provides information for aiming purposes. The system includes BIT with 95 per cent failure detection/fault isolation.

SPECIFICATIONS

Dimensions	
(electronic unit)	274.3 x 190.5 x 198mm
(control unit)	63.5 x 139.7 x 76.2mm
(helmet display unit)	88.9 x 38.1 x 38.1mm
Weight	
(electronic unit)	5.2kg
(control unit)	0.4kg
(helmet display unit)	0.23kg
Resolution	512 x 512 pixels
Reliability	>1000 h MTBF

STATUS
Installed on US Army and US Marine Corps helicopters such as the UH-60A/L, AH-1F, CH-46E, UH-1N/H/V, CH-47D and OH-58A/C.

COMPANY NAME
AEL Defense Corporation

Longbow Radar

PUBLICATION
Jane's Avionics 1995-96

SECTION
Radar

TITLE
Longbow Radar

COMPANIES
Lockheed Martin Electronics and Missiles Group; Northrop Grumman Corporation, Electronic Sensors and Systems Division

DESCRIPTION
Longbow radar forms part of the Longbow fire-and-forget anti-armour system which is being fitted to AH-64D Apache battlefield attack helicopters. The radar subsystem comprises a low probability of intercept millimetric radar mounted in a toroidal radome at the top of the helicopter's main rotor mast and a millimetric radar for the Hellfire II missile. The Longbow radar is designed to interface with the AH-64's fire control system and provides rapid target area search; automatic target detection, classification and prioritisation; fixed and moving target detection at maximum standoff range and missile fire-and-forget capabilities. As such, the radar is claimed to provide a ten-fold improvement in battlefield effectiveness over the non-radar AH-64A. An integrated passive radar band interferometer subsystem is used to locate and identify radiating targets, while the equipment as a whole identifies and ranks targets in priority order for attack by upgraded modular Hellfire missiles.

OPERATIONAL STATUS
The Longbow system is a joint venture between Northrop Grumman's Electronic and Systems Division and Lockheed Martin Electronics and Missiles. Long lead procurement for the first production lot of radars and millimetric Hellfire seekers was sanctioned in December 1994. Initial Operational Test and Evaluation of the equipment was completed in March 1994 and the system is reported to have completed full scale development "on schedule and to cost" in the fourth quarter of the year. As of this edition, limited rate production of the radar and seeker were scheduled to be approved during October 1995 with the necessary contract being awarded in the following December. As of February 1995, Jane's sources were suggesting that McDonnell Douglas (the AH-64D's manufacturer) had received a $279.6 million contract to remanufacture 18 AH-64As to AH-64D standard with deliveries scheduled to begin in March 1997. A follow-on five-year agreement is expected and will cover at least 232 aircraft.

SPECIFICATIONS

None available.

MMS Mast Mounted Sight

PUBLICATION
Jane's Electro-Optic Systems 1995-96

SECTION
Ground Attack – Integrated Systems – Helicopter

TITLE
McDonnell Douglas MMS Mast Mounted Sight

TYPE
Integrated systems – helicopter

DESCRIPTION
The MMS consists of three subsystems; the sensor head, the control panel and the onboard electronics. The system is cooled with a self-contained glycol mixture system and is linked by a Military Standard 1553B databus. High field, rare earth magnets float the sensor package. This is mounted above the rotor head permitting the aircraft to carry out target acquisition, recognition and laser designation while concealed.

Within the head is a Northrop Electronics Systems Division sensor package consisting of a Loral Fairchild low-light level television camera, a thermal imager based upon the 120-element MCTNS modules and the Litton MMS-LRF/D 1.06 — laser rangefinder and designator. The sighting system includes a video tracker which provides both manual and automatic tracking of targets. There is also a digital scan converter which enhances the thermal imaging sensor image and provides frame freeze and x2 magnification zoom capability.

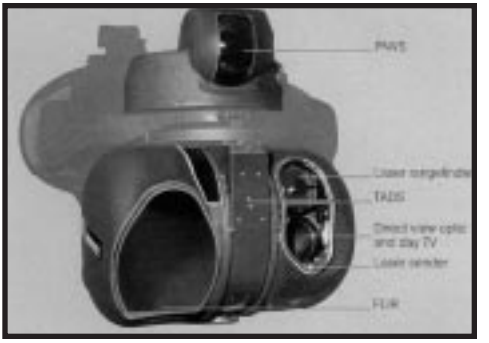
There is a control/display system consisting of a master controller linked to the keyboard, display system and handgrip. A fire control system with processor and remote Hellfire missile electronics, as well as TOW firing capability, may be added.

The sensors enable the scout helicopters to seek and to designate targets at extended ranges during the day or night, irrespective of battlefield haze or smoke.

SPECIFICATIONS

Weight	113.4kg	
Sensor head		
Diameter	64.77cm	
Weight	72.57kg	
Field of regard		
Bearing	+-190°	
Elevation	+-30°	
Thermal imager	Field of view	2.8°; 10°
Television	Field of view	2°; 8°
Type	low-light silicon vidicon	

Target Acquisition Designation Sight / Pilot Night Vision Sensor



PUBLICATION
Jane's Avionics 1995-96

SECTION
Electro-Optics

TITLE
Target Acquisition Designation Sight/ Pilot Night Vision Sensor

COMPANY
Martin Marietta

DESCRIPTION
Martin Marietta's Target Acquisition Designation Sight/Pilot Night Vision Sensor (TADS/PNVS) is designed to provide day, night and limited adverse weather target information and navigation capability for the US Army AH-64A Apache attack helicopter. The TADS/PNVS system comprises two independently functioning subsystems known as TADS and PNVS.

TADS provides the co-pilot/gunner with search, detection and recognition capability by means of direct view optics, TV or FLIR sighting systems which may be used singly or in combinations according to tactical, weather or visibility conditions. The PNVS subsystem provides the pilot with flight information symbology which permits nap of the earth contour, on low-level flight to, from and in the combat area at low altitudes.

TADS consists of a rotating turret, mounted on the nose containing the sensor subsystems, an optical relay tube located at the co-pilot/gunner station, three electronic units in the avionics bay and cockpit controls and displays. TADS turret sensors have a field of regard ±120° in azimuth and +30 to -60° in elevation. By day, either direct vision or television viewing may be used.

Once acquired, targets can be tracked manually or automatically for autonomous attack with guns, rockets or Hellfire anti-tank missiles. A laser may also be used to designate targets for attack by other helicopters or by artillery.

PNVS consists of a forward-looking infra-red sensor system packaged in a rotating turret mounted above the TADS, an electronics unit located in the avionics bay and the pilot's display and controls. The system covers a field of ±90˚ in azimuth and from +20 to -45˚ in elevation. Field of view is 30˚ x 40˚.

TADS provides a backup PNVS capability for the pilot in the event of the latter system failing. The pilot or the co-pilot/gunner can view, the video output from either TADS or PNVS, raising the probability of mission success Although designed primarily for combat helicopters flying nap of the earth missions, PNVS may be used as a single entity in tactical transport and cargo helicopters.

Appendices

APPENDICES

AH-64D LONGBOW VS. LONGBOW 2

Besides being *Windows-95* native, *Longbow 2* has an array of new capabilities — while preserving elements you know and love from the first *Longbow*. Many added features are a direct result of feedback from sim players who have spent hours analyzing the game.

This section overviews the game's major changes:

Multi-player play (2-4 players)	Two new player helicopters
Two new campaigns	Mission planner
Dynamic campaign generator	3-D graphics/art effects

Multi-Player Play

Longbow 2's multi-player capabilities allow you to fly the game with your friends (or enemies) in several ways — either through a Local Area Network (LAN — 4 players), TCP-IP (Internet — 2 players), direct cable (serial — 2 players) or modem (2 players). Each player must have a separate copy of the game CD.

Using any connection type, you can fly as a pilot or co-pilot/gunner (CP/G). Players can pair up in two-man crews or fly separate aircraft.

See the *Multi-Player Games* booklet for details.

See **Cockpit**, p. 2.40, for an explanation of the Comms MFD (useful during multi-player play).

Campaigns

The game has two new dynamic campaigns with a wide range of mission objectives — the first campaign simulates a full-scale war game at the National Training Center at Ft. Irwin, California. The NTC campaign is a great way to practice your piloting and weaponry skills, or test your skills against other live pilots in a force-on-force, multi-player setting.

A second, in-depth campaign occurs in Iran and Azerbaijan, where you handle a realistic conflict dealing with the Caspian oil resources. You also manage limited helicopter and weapon resources throughout the war.

See **Campaigns**, p. 6.1, for Jane's articles and background campaign information.

Dynamic Mission Generator

Longbow 2 utilizes a dynamic campaign system. Instead of static missions, different ones are generated each time you play, based on decisions you've made and objectives you've met. Battle lines shift realistically according to successes and failures.

See **Campaigns: Dynamic Mission Generator**, p. 6.19.

Mission Planner

The Mission Planner now has extra functionality and a totally new look and feel. In it, you can assign pilot and CP/G duties, outfit and arm up to four flights (eight helicopters), set up multi-player tasking assignments, adjust waypoints and delay times, rehearse missions for timing, and check terrain altitudes. You also have control over limited weapon and helicopter resources during campaigns.

See **Mission Planner**, p. 1.11, for Mission Planner modifications.

See the **Multi-Player Guide** for multi-player options.

3-D Graphics / Art / Terrain

A completely new graphics engine fully supports the 3DFX graphics accelerator card, allowing detailed graphics and terrain with dynamic effects.

Graphical high points include terrain that is four times larger than that of the original game, extra graphical detail, full-color dynamic light sourcing, realistic night-time effects (explosions, flames and illumination effects), visible smoke and dust trails, and 3-D virtual cockpits.

Player Helicopters

Longbow 2 allows you to pilot the AH-64D Longbow Apache (and the AH-64D without the Longbow radar), the OH-58D Kiowa Warrior scout helicopter and the UH-60L Black Hawk utility/transport helicopter.

The varying roles of these three helicopter types give the game a new dimension and portray a wide range of mission types.

Additionally, a new Communications MFD has been added to all three helicopters. See **Cockpit**, p. 2.40., for details.)

For more information on the new helicopters and their cockpit systems, see **Cockpit** (p. 2.1), as well as **Combat** (p. 5.1).

ACRONYMS

AAA	Anti-aircraft artillery	Heavy version of anti-aircraft gun, also known as "arty."
AAC	Army Air Corps	
AAH	Advanced Attack Helicopter	
AFCS	Automatic Flight Control System	Controls both the autopilot and auto-hover mechanisms.
AFV	Armored Fighting Vehicle	Used in front line combat, essentially a tank with tires instead of treads.
AGM	Air-to-Ground Missile	
AH-xx	Attack Helicopter	U.S. military designation.
APC	Armored Personnel Carrier	Armed, rough-terrain vehicle with tracks or wheels used to transport troops.
APR-39		Digital threat warning system used on helicopters and light aircraft.
APU	Auxiliary Power Unit	
ASE	Aircraft Survivability Equipment	Physical and electronic countermeasures.
ATGM	Anti-Tank Guided Missile	Missile guided by lasers, wires or infrared signals.
ATHS	Airborne Target Handoff Subsystem data link	
AWACS	Airborne Warning And Control System	
BMP	Boyevaya Mashina Pekhoty	Russian, combat vehicle, infantry; also called "bimp."
CM	Countermeasures	Used by aircraft against air-to-air or surface-to-air weapons (chaff, flares and jammers).
CP/G	Co-Pilot/Gunner	Sits in the front seat of helicopters with tandem seating, and on the left in helicopters with side-by-side seating.
CPO	Co-Pilot/Observer	Sits in the left seat of helicopters with side-by-side seating (such as the Kiowa Warrior), and is responsible for sensors and weapons.
DASE	Digital Auto-Stabilization Equipment	
DoD	Department of Defense	
DMM	Digital Moving Map	
ECM	Electronic Countermeasures	Equipment that counteracts electronic targeting systems.
EW	Electronic Warfare	

FARP	Forward Arming & Refueling Point	Highly mobile helicopter base; normally airlifted in by heavy transport helicopters.
FFAR	Folding Fin Aerial Rocket	
FLIR	Forward-Looking Infrared device	Displays the heat signatures of nearby objects.
FLOT	Forward Line, Own Troops	Current designation for the front line closest to the enemy.
FOR	Field Of Regard	Total extent to which a camera or missile seeker head can pivot or "look."
FOV	Field Of View	Extent a camera or missile seeker head can "see" in a given position.
GPS	Global Positioning System	Satellite-based navigation system.
HIRSS	Hover Infrared Suppressor System	
HQ	Headquarters	
ICS	Internal Communication System	Communications link between pilot, CP/G (and crew on some helicopters).
IFV	Infantry Fighting Vehicle	Lightly armed, tracked vehicle used to transport infantry.
IHADSS	Integrated Helmet and Display Sight System	Coordinates sensor and targeting systems with pilot's head movements; computer displays flight info and targeting data over camera images in the helmet's eyepiece.
INS	Inertial Navigation System	Tracks a helicopter's current and desired positions.
IR	Infrared	Portion of the electro-magnetic spectrum where a signal's intensity is directly related to its heat signature.
LOS	Line Of Sight	A straight, unblocked path between a missile's seeker head or designation system and its target.
LZ	Landing Zone	Designated landing zone for parachute or helicopter units.
MBT	Main Battle Tank	Medium and heavy tanks.
MEDVAC	Medical Evacuation	Helicopter transport of casualties.
MFD	Multi-Function Display	
MMS	Mast-Mounted Sight	
MPSM	Multi-purpose submunition rocket	
MoD	Ministry of Defence	
MRLS	Multiple Rocket Launching System	

NATO	North Atlantic Treaty Organization	A mutual defense treaty that includes 16 nations. They are all European based with the exceptions of the United States and Canada.
NOE	Nap-of-the-Earth	Flight at very low altitudes, using terrain for cover.
OH-xx	Observation Helicopter	U.S. military designation.
PDU	Pilot Display Unit	
PNVS	Pilot's Night Vision Sensor	Uses infrared data to enhance object viewing at night.
RDF	Rapid Deployment Force	Military force capable of quick movement, often used to respond to military hotspots.
RWR	Radar Warning Receiver	Warns pilot when he is being tracked by an enemy missile guidance system or air intercept radar.
SAM	Surface-to-Air Missile	
SEAD	Suppression of Enemy Air Defenses	Mission to destroy enemy air defense units.
Su-xx	Sukhoi	Designates aircraft designed by the Soviet Sukhoi Bureau.
TADS	Target Acquisition and Designation System	System in Apache helicopters used to lock onto targets and to control laser designator.
TF	Task Force	A battalion- or squadron-sized combat formation composed of mixed combat elements.
TFR	Terrain-Following Radar	
TIALD	Thermal Imaging and Laser Designation	
TIS	Thermal Imaging System	Infrared viewing system that illuminates objects at night or during adverse weather conditions.
TOW	Tube-launched, Optically-tracked, Wire-guided	
TSD	Tactical Situation Display	
TVS	TeleVision System	
UAE	United Arab Emirates	
UH-xx	Utility Helicopter	US military designation.
VSI	Vertical Speed Indicator	
VSD	Vertical Situation Display	

GLOSSARY

Advancing blade. Blade during the half of its revolution in which it travels in the same direction as the aircraft.

Airfoil. Curved wing or blade surface that produces lift when air passes over it.

Airframe. Basic structure of an aircraft (doors, landing gear, seats, cabin, etc.).

Angle of attack. Angle between the chord of a rotor blade and the direction of air passing over it.

Angle of incidence. Angle between the chord of a rotor blade and the plane of rotation of the rotor disc.

Asymmetry of lift. Unequal lift that results when the helicopter is in horizontal motion. The retreating rotor blades move more slowly than the advancing blades, and create less lift. This causes single-rotor helicopters to veer upward and sideways. Pilots compensate by using the directional control pedals.

Autorotation. Non-powered flight; air passing through the rotor disc causes the rotor blades to turn, maintaining lift.

Battalion. U.S. military unit with two or more companies and anywhere from 500 to 1,500 men. (Cavalry and helicopter battalions are often called "squadrons.")

Bernoulli's principle. As the speed of a fluid increases, its pressure decreases. Air behaves like a fluid as it flows around an airfoil. The foil is designed so that the top surface is longer than the bottom; air must travel faster over the top surface, creating a low pressure area above the airfoil and adding to the airfoil's lift.

Blade. Airfoil surface of a helicopter used to create lift.

Blade stall. Condition that occurs when the angle of attack of the blades is so great that no lift is generated.

Chaff. Small filaments or metallic strips released to reflect/confuse signals from radar-guided weapons.

Chord. Imaginary line that passes through the leading and trailing edges of an airfoil.

Collective. Helicopter control used to collectively alter the pitch (angle) of all the rotor blades simultaneously.

Company. U.S. military organization consisting of two or more platoons and anywhere from 100 to 300 soldiers. (Cavalry or helicopter companies are often called "troops.")

Coning. Upward "flexing" of a helicopter's rotor blades. The coning angle is determined by the weight of the helicopter and the rotor RPM.

Coordinated turn. What happens when tail rotor and cyclic (linked via computer) work together to produce a smooth, constant banking turn. When the coordinated turn feature of the Longbow Apache is activated, the directional control pedals automatically coordinate with the cyclic control to produce a smooth turn.

Countermeasures. Defensive measures used by aircraft against air-to-air or surface-to-air weapons (chaff, flares and jammers).

Cyclic. Helicopter control used to selectively change pitch (angle) of individual rotor blades as they move through the path of revolution. The cyclic controls the "tilt" of the rotor disc, and affects direction and speed.

Disc area. Area through which the rotor blades pass during each revolution.

Drag. Force that counteracts an object in motion through the air, also called air resistance.

Force Trim. Resetting the centered position of the cyclic stick to maintain a contant horizontal velocity, instead of a stationary hover.

Ground effect. Air "cushion" produced when a helicopter hovers at low altitude.

Gunship. Slang for an armed attack helicopter, or an armed, non-fighter plane.

Helicopter. Rotary-winged aircraft that flies horizontally and vertically using lift created by a powered rotor system.

Helmet Reticle. Small circular "glass" positioned over the pilot's right eye that superimposes important combat and flight information over a camera image of the outside world.

Hover hold. Maintaining a constant position at a constant altitude.

Jammer. Source of intense infrared or radio energy used to confuse guided weapon systems.

Klick. Slang for kilometer.

Knot. Unit of horizontal motion equal to 1.1 mph (approximately 6,076 ft/hr or 1 nautical mile/hour).

Lift. Upward force produced as air passes over an airfoil. Pressure above the airfoil surface is less than that below the airfoil, which causes the lifting force.

Terrain masking. The tactic of using naturally occurring objects as cover from the enemy.

Nautical mile. Aeronautical unit for measuring distances (see knot).

Platoon. U.S. military unit just below a company with anywhere from 25 to 50 soldiers.

Point of impact. Point along the leading edge on an airfoil where the air separates over the top and bottom.

Pull pitch. To quickly add collective.

Rate of climb. Vertical rate of ascent, measured in feet per second (ft/sec) or meters per minute (m/min).

Rotational velocity. Speed of the blades as they rotate around a center point. Also called angular velocity.

Rotor. Engine-powered system in a helicopter that creates lift. A rotor consists of a main shaft that turns and rotates from two to four blades in a circular motion. The pitch of the airfoils (blades) creates lift.

Settling with power. Condition that occurs with a vertical descent at low forward airspeed. The speed of airflow through the rotor is slower than the rate of descent, causing lift in a downward direction.

Shaft horsepower. Power rating for helicopter engines.

Side slip. "Skidding" condition that occurs when the helicopter is in forward motion and turns sharply. The aircraft temporarily slides in the original direction of motion, regardless of the helicopter's current heading.

Slick. Slang for unarmed transport helicopter.

Tail rotor. Small vertical rotor system mounted on a helicopter's tail. This rotor pushes the tail left and right, helping to counteract the torque produced by a single-rotor helicopter.

Thermal Imager. Night-time vision system similar to FLIR, but recognizes moving objects.

Translation tendency. Tendency of a single-rotor helicopter to drift to the right while hovering. This is due to the force created by the anti-torque (tail) rotor.

Translational lift. Additional lift produced by horizontal airspeed. When the helicopter moves from a hover into forward motion, the relative wind passing over the tilted rotor blades creates more lift.

Weapons Free. Term signalling full freedom to utilize weapons against targets.

Weapons Hold. Term signalling crews to hld their weapon fire.

FLIGHT CHARTS

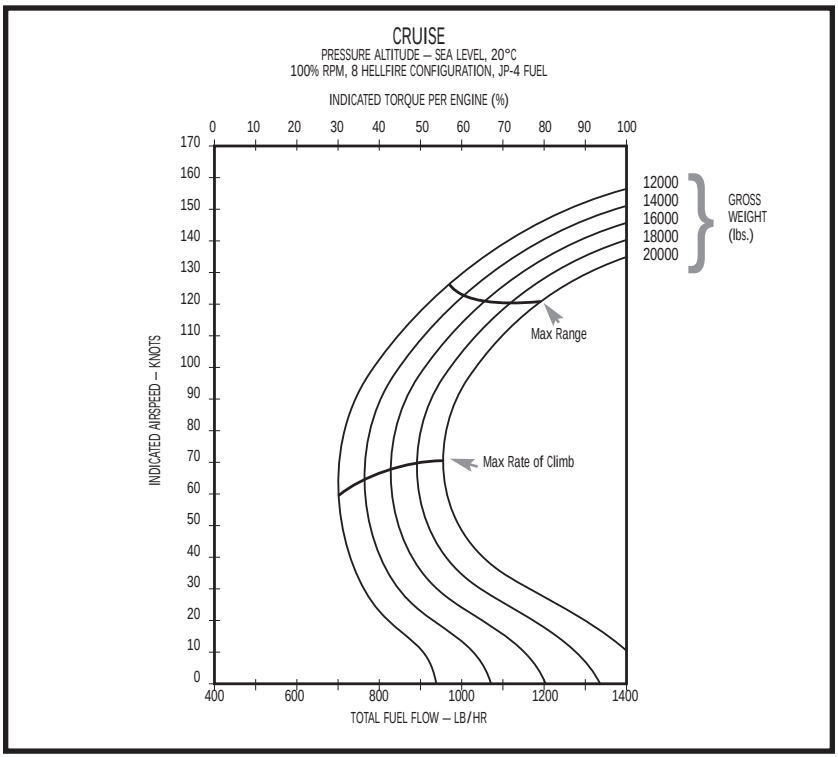
Cruise Charts

Cruise charts depict how helicopters perform when flying at different airspeeds and total weights. All helicopters have a cruise chart specific to that aircraft. To use a cruise chart, find your airspeed and weight on the chart, then read across to determine the torque load on each engine and your fuel flow. Optimal performance occurs between the MAX RANGE and MAX RATE OF CLIMB points.

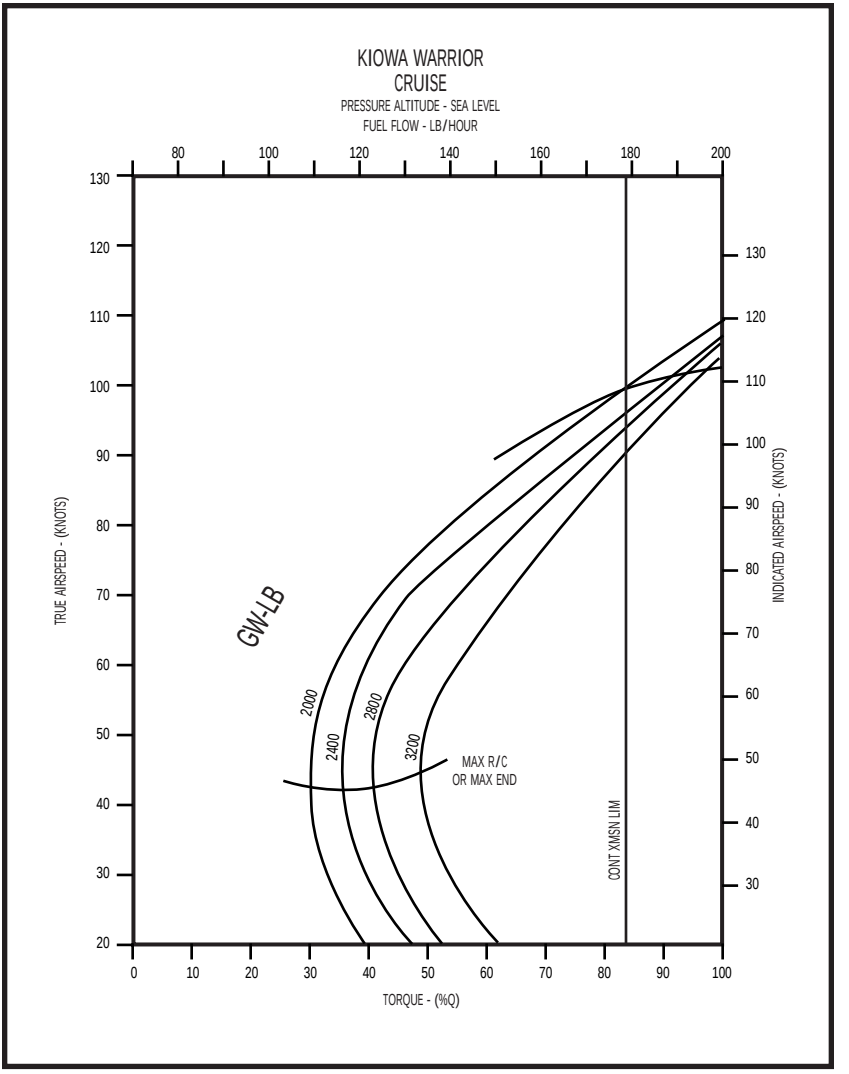
In the game, when **WEIGHT EFFECT** is off on the **OPTIONS** menu, helicopters fly at their empty weights (given below). If this option is off, they fly at their total combat weight:

	Empty Weight	Total Combat Weight
Longbow	11,800 lbs.	17,032 lbs.
Black Hawk	11,516 lbs.	17,342 lbs.
Kiowa	3,289 lbs.	5,200lbs.

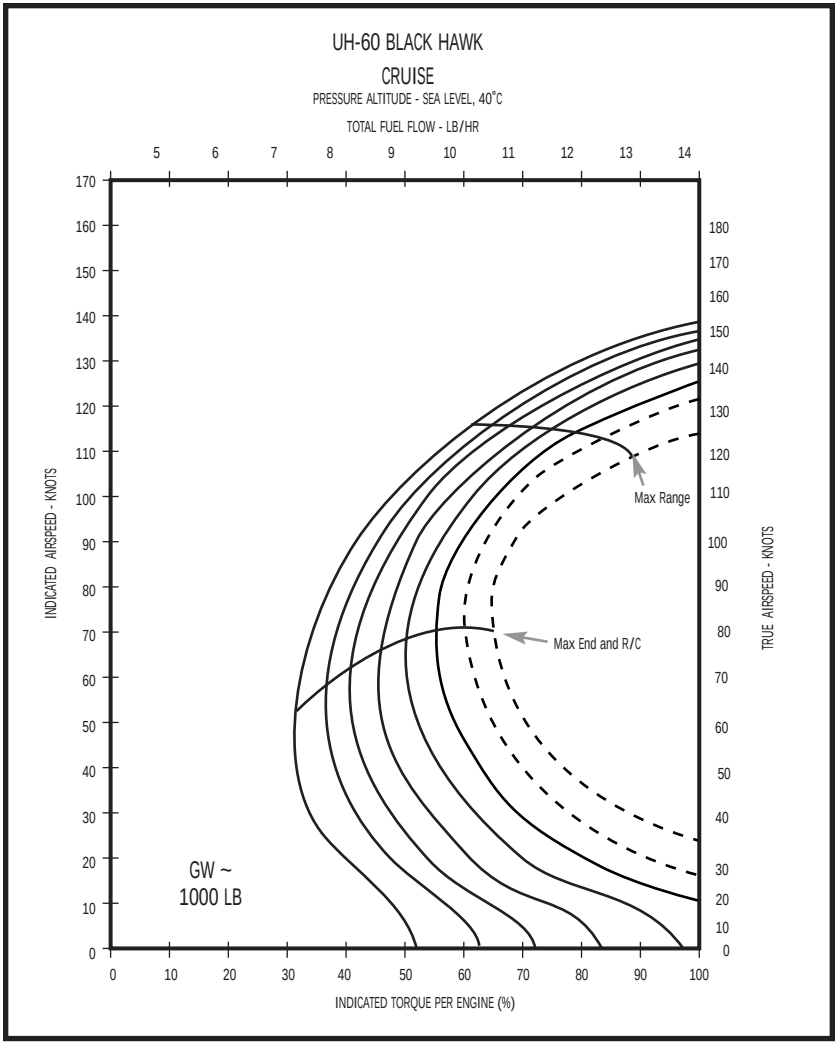
AH-64D Longbow



OH-58D Kiowa Warrior



UH-60L Black Hawk



Autorotational Descent Charts

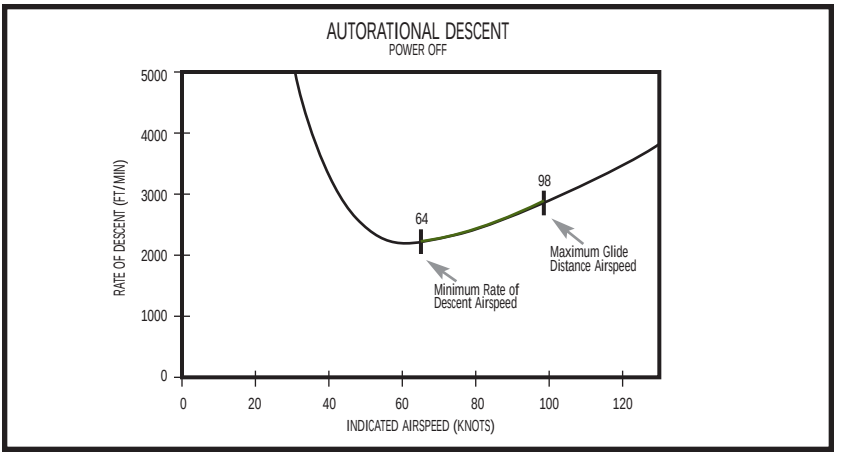
One of the most terror-filled periods of pilot training is practicing emergency landing procedures. An autorotational landing is an emergency landing made without power to either engine. In this type of landing, the rotor is disengaged from the engine, and air moves through the rotor disc as the helicopter keeps its forward momentum. This keeps the blades revolving, even without power. Autorotational landings can only be made if the helicopter is already moving forward when the engines shut down.

The following charts map the helicopters' rate of descent at different airspeeds during autorotational flight. The bar marks the rate of descent/airspeed combinations conducive to a safe landing. A lower airspeed (around 60 -70 knots) will give you a minimum rate of descent (softest landing), but higher airspeeds (100 knots or greater) will allow you glide the farthest before landing.

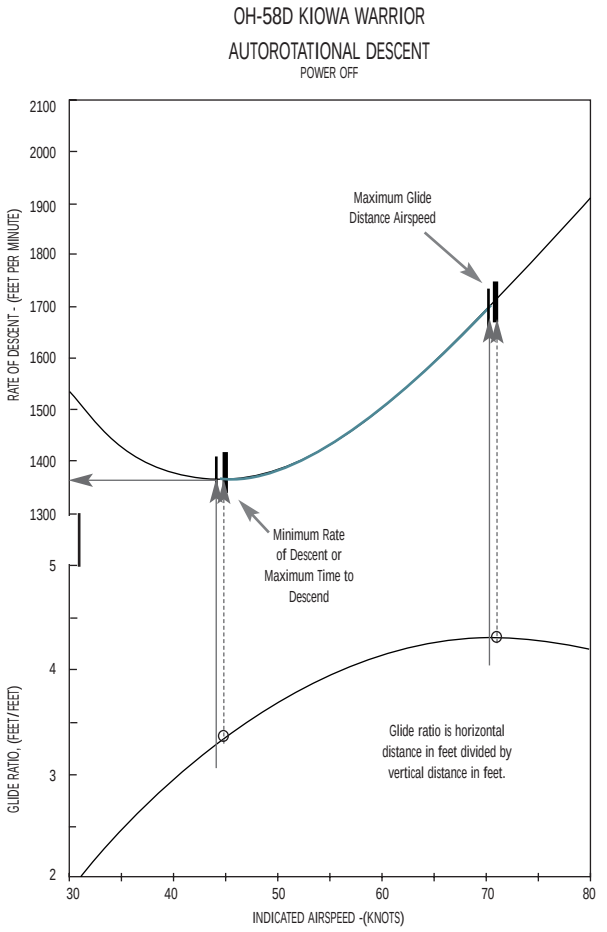
Below the Curve. If your airspeed and descent fall beneath the safe autorotational descent curve, rotor RPM is too low, and you aren't generating enough lift to glide safely. If you have some altitude to play with, you can increase speed by nosing down into a slight dive and lowering collective. This will increase your lift.

Above the Curve. If your rate of descent and airspeed measure above the curve on the chart, your rotor RPM is too high. Raise collective slightly to lower your RPM.

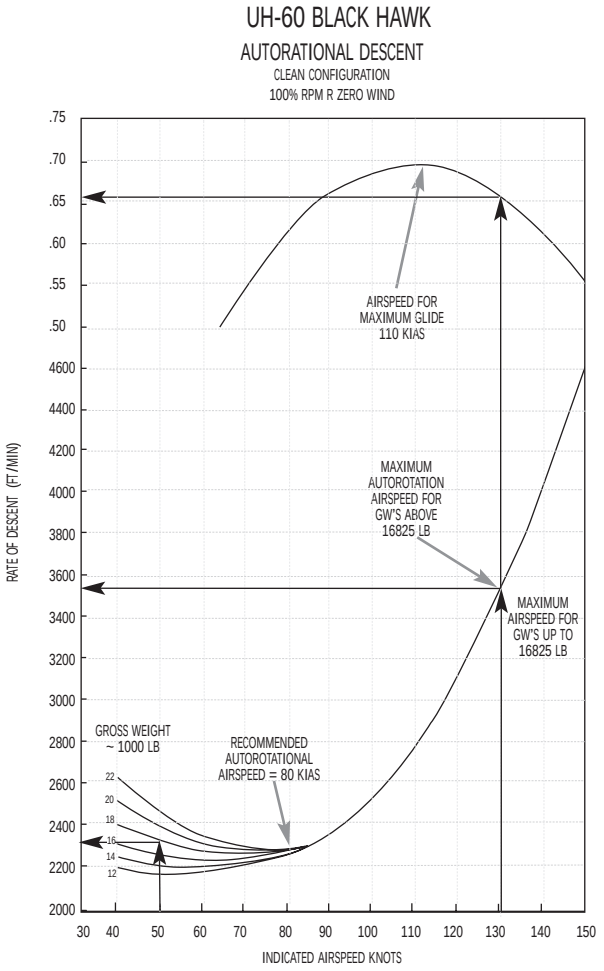
AH-64D Longbow



OH-58D Kiowa Warrior



UH-60L Black Hawk



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MULTI-PLAYER GAMES

Longbow 2 supports multi-player play, allowing you to match up your piloting skills against other human pilots. You can fly as a pilot or co-pilot/gunner — either teaming up with a friend in the same cockpit, or flying separate aircraft.

Specifically, you can play *cooperatively* in Random, Death Match (Instant Action), NTC campaign and Iranian campaign missions, or *head-to-head* in Death Match (Instant Action) and NTC campaign missions.

In all multi-player games, one player — called the "Master" — hosts the game and sets up the mission parameters. Any other players are "Slaves" and have limited control over pre-mission options. A game can have multiple Slaves, but only one Master.

- **Quick Connect Steps** (below) will get you up and running.
- **Multi-Player Campaign Games** (p. 12) describes how the campaigns work in multi-player mode.

The rest of the chapter describes how to start games using the four different connection types. Network and Internet setups are nearly identical — therefore, these two connection types are covered under a single section.

• **Network or TCP/IP**	(p. 6)	2-4 players (network), 2 players (Internet)
• **Modem**	(p. 10)	2 players
• **Direct Cable (Serial)**	(p. 11)	2 players

Quick Connect Steps

1. From the *Base* screen, select the *Commo Building.*
2. Select a multi-player game type.
   - **TCP/IP** (Master player) — Select **monitor**.
   - **TCP/IP** (Slave player) — Select **keyboard**.
   - **LAN** — Select **folder**.
   - **Modem or Direct Cable/Serial** (Master/Slave) — Select **rotary card file.**
   - **Modem/Direct Cable** (Master) — Select **phone**.
3. (Master only) Create a new game.
   (Slaves) Join an existing game.
4. (Master only) Select **PLAY GAME**. This returns you to the *Base* screen.
5. (Master only) Select a mission type.
6. (Master only) Select multi-player game options (Death Match and Single missions only).
7. (Master, Slaves) Set up Mission Planner options.
8. (Master only) Start the game.

Detailed Connect Steps

Multi-Player Campaign Games

The campaign system can support from 2 players (modem, direct cable (serial), TCP/IP) up to 4 players (LAN) in both cooperative play and head-to-head multi-player combat.

When players connect for a multi-player campaign game, one player is the *Master* and the others are *Slaves*. Only the host computer can load or save a campaign game. If you want to continue playing the campaign using one of your saved games, you'll need to host the game.

Even if you've started playing the campaign in single-player mode, you can have other players join the game. Similarly, it doesn't matter who plays with you from mission to mission in the campaign. If you played a friend in another city last week and want to fly against a co-worker this week, you can.

Any player can join in, drop out, or change sides during a multi-player campaign. The only restriction is that the Master player has to load and participate in every mission, since the campaign data is stored on that computer.

If the master drops out of a game, however, all players must re-establish a connection.

Note: You can fly cooperatively in either the NTC or Iranian campaign, or fly head-to-head in the NTC campaign.

Troubleshooting

If you have problems connecting with another player, contact your network supervisor, or consult your hardware / modem documentation.

You can also get information by going to the *Windows 95* **START** menu and left-clicking **HELP**.

- Left-click on the ***Contents*** tab, then double-left-click **HOW TO**.
- For help with network connections, double-left-click **USE A NETWORK**.
- For help with modem setup, double-left-click **SET UP HARDWARE**, then **SETTING UP A MODEM**.

Matchmaking

The Jane's web site has information on existing and upcoming simulations, as well as chat boards and a match-making service that can help you find multi-player opponents across the country.

- Visit **WWW.JANES.EA.COM**.
- Left-click **ONLINE GAMING**.
- A log-in screen appears. Follow the on-screen instructions to create a new account.

  If you have an existing account for another Jane's product, you can use that same account for *Longbow 2.* Simply enter your callsign and password, then press **OK**.
- Select *Longbow 2* from the Game Selection screen.
- A pop-up dialog box appears. Select the type of *Longbow 2* game you want to play.

STEP 1 — MULTI-PLAYER CONNECTION SCREEN

LAN, TCP/IP, Modem

To initiate a multi-player game, left-click on the Communications Building in the *Base* screen. (Commo Building (Multi-player) appears when you move your mouse over the building.)

Selecting this building displays the *Multi-Player Connection* screen. From here, you select the connection type — Network (LAN), TCP/IP (Internet), Modem or Direct cable (serial):

Once you've done so, read the appropriate section to set up that game type:

Network / TCPIP	(**p. 6)**
Modem	**(p. 10)**
Direct Cable (Serial)	**(p. 11)**

Rotary Card File **(Modem)** This file lets you store cards with the name and phone numbers of your multi-player modem opponents. (You can use this file or the phone to call someone via modem.)

If you want to use an existing card, left-click the top/bottom of the thumbwheel to flip through the cards. Then, left-click on the card containing the number you wish to dial.

Phone **(Modem or Direct Cable/Serial)** Left-click the phone to make or answer a modem or direct cable (serial) connection. This displays a dialog box:

ANSWER VIA MODEM Wait for a modem call from the Master player.

SERIAL CONNECTION

ANSWER VIA Wait for a direct cable (serial) connection.

CONNECT VIA MODEM Initiate a modem call to the Slave player. Type in a phone number, then left-click **DIAL** (or **CANCEL**). To enter this card into

SERIAL CONNECTION

your rotary card file, left-click **ADD NUMBER TO ROLODEX.**

CONNECT VIA Initiate a direct cable connection to the Slave player.

CANCEL Close the dialog box.

Monitor **(TCP/IP / Master)** Left-click to set up a new TCP/IP (Internet) game and act as the Master.

Keyboard **(TCP/IP / Slave)** Left-click to access a new TCP/IP game as a Slave player. Left-click in the field and type in the Master player's IP address — you must know this before playing. Then, press **OK**.

(Master only) You must give all players your IP address before they can make a TCP/IP connection.

To find out what it is, run WINIPCFG.EXE. This file can be found in your *Windows* directory. Look at the address next to the *IP Address* field, and give other players the address before they attempt to join your multi-player game.

Folder (LAN) Left-click to access a new LAN network game.

Jane's Book View *Jane's* specifications in the game's object viewer for all of the major objects in the game. (See **Read Jane's**, on p. 1.1 of the **Reference Manual**.)

Note: *This option takes you out of the current screen, and isn't available after you are connected to a multi-player game.*

In / Out Trays Return to the *Base* screen.

STEP 2A — NETWORK OR TCP/IP GAME

LAN Connection

From the *Multi-Player Connection* screen, left-click the folder. “Connect on a Network” appears when you move your mouse over the folder.

This takes you to the *Multi-Player Game Setup* screen, whether you’re the Master player or a Slave player. Here, you can create or join network (LAN) or Internet (TCP/IP) games.

TCP/IP Connection

In the Multi-Player Connection screen, “Wait for Players to connect from Internet (Master Operation)” appears when you move your mouse over the monitor, and “Connect to Master on Internet (Enter Master IP Address)” appears when you move it over the keyboard.

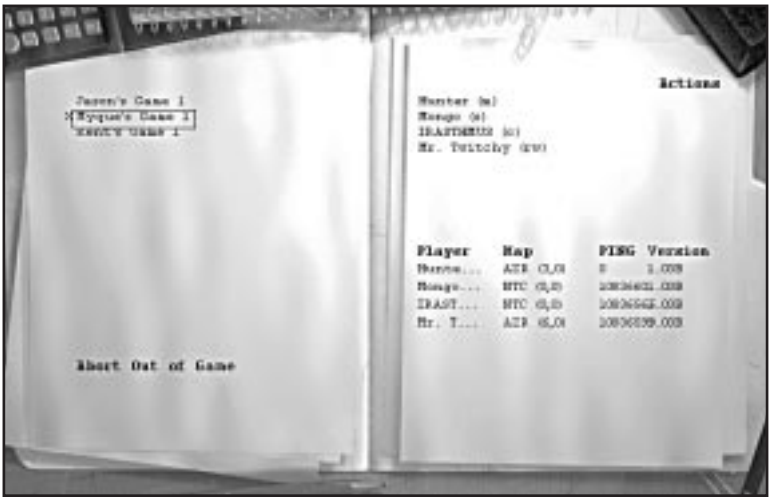
Left-click the monitor (to be the Master player) or keyboard (to be a Slave player) in the *Multi-Player* screen.

(Master) After you choose the monitor, you go directly to the *Multi-Player Game Setup* screen.

(Slave) After you select the keyboard, type in the Master player’s IP address in the dialog box that displays. The Master player should send this to you before you try to connect. Next, left-click OK.

The next screen you see is the *Multi-Player Game Setup* screen. Here, the Master player creates games that slaves can join. The following sections describe how to create and join games.

Note: *(Master) When you create a TCP/IP game, it is automatically named for you.*



Multi-Player Game Setup Screen

LAN / TCP/IP Connection

This step describes how to set up a Local Area Network (LAN) game. The left side of the screen lists available games, while the top right side of the screen lists individual players for the currently selected game.

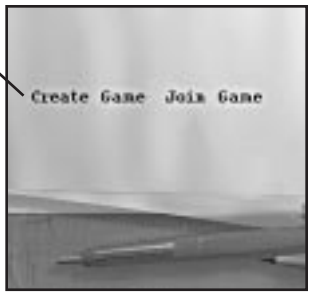
Once the Master creates a game, it appears on the left side of the screen, and other players can join it. The options on the left side of the folder are different for the Master and Slave players.

Master-Only Options

Create Game. Host a new game. Select this option to create a game and act as the Master player.

Once you select this, the option changes to **PLAY GAME**. After you set up the game, left-click this to start the game.

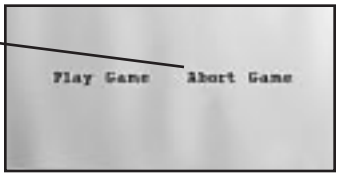
Also after you **CREATE GAME**, **ABORT GAME** appears. Use this button to delete a game you've created.



Disconnect a joined player. (Only the Master player can do this.)

Set a limit on the number of players who can join your game by blocking off empty player slots.

(Master) Cancel this multi-player game. No game information will be saved.



Left-click **CLOSE** to reduce to number of player slots for this game.

To create a game:

1. Left-click **CREATE GAME**.
2. Type in a name for your game (up to 15 characters long). You can use spaces and punctuation marks.
3. Press Enter to add the new game to the *Available Games* list.

To decrease available player slots:

1. Left-click **CLOSE** next to the last empty player name slot. This makes the slot unavailable to players who wish to join the game.

   To re-open a closed slot, left-click **OPEN**.

To reject connected players:

1. Left-click **REJECT** next to the player's name.

To close game / begin play:

- Left-click on **ABORT GAME** to delete the currently selected game.
- Left-click **PLAY GAME** to continue.

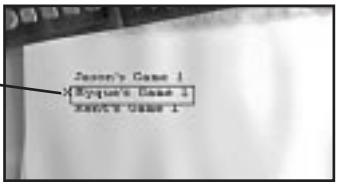
Once the Master player presses **PLAY GAME**, the game is set up and the *Base* screen appears. If the Master player selects a Death Match or Single mission, the *Multi-Player Mission Option* screen appears. For other missions types, it does not.

Slave-Only Options

Join an existing game created by the host. Select this option if you want to attach to someone else's game as a Slave player.

Once you select **JOIN GAME**, the text changes to **ABORT** out of game. Left-click this to disconnect from a game you've joined.

Currently selected game.



To join a game:

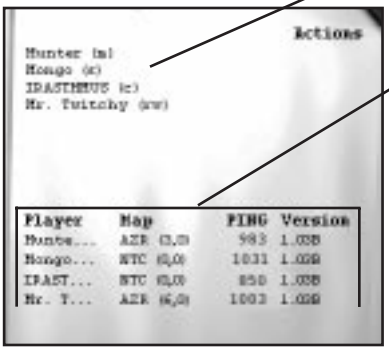
1. Left-click a game name on the left side of the screen.
2. Left-click **JOIN GAME**.

To disconnect from a game:

1. Left-click **ABORT OUT OF GAME**. (You can then re-join, or join a different game.)

Once you have successfully joined the game, your name appears on the right side of the screen. Even after you join, however, the Master can **REJECT** you.

General Options (Master and Slaves)



Slave players who have joined the currently selected game. Clicking another game on left side of the folder changes the names listed here.

Information about connected players.

Player	Callsign
Map	Currently decompressed map
Ping	Latency (connection speed)
Version	Current version of game

(Slave) Disconnect from a game you've joined.

Return to the *Multi-Player Game Setup* screen.

Continue with **Step 3 — Multi-Player Mission Options**, p. 12.

*Note that a semi-transparent, rectangular window now appears on screen. See **Chat Window**, p. 14, for details.*

STEP 2B — MODEM GAME

Modem Connection

A modem game involves a Master player (the player that dials) and a Slave player (the player that answers).

Master. To initiate a modem call from the *Multi-Player Connection* screen, left-click on the telephone and select **CONNECT VIA MODEM**. Or, left-click on a card in the rotary file.

Slave. Left-click the telephone in the *Multi-Player Connection* screen, then select **ANSWER VIA MODEM** to wait for a call from the Master player.

Rotary Card File

The rotary card file keeps track of people you've connected with via modem. The cards store the name and phone numbers of your multi-player modem opponents. You can store unlimited names and numbers in this file, and you can delete or add names and numbers at any time.

- (Master) Left-click on the top or bottom of the thumbwheel to flip the card stack forward or backward.
- (Master) To dial a player you've played before, flip to that completed card and left-click on it. Then, left-click **DIAL**.

To add a new card:

1. Left-click the **PHONE** and select **CONNECT VIA MODEM**.
2. Type in the phone number you wish to dial. Include any prefixes (such as "9" for dialing an outside line). Do not use spaces or hyphens between numbers.
3. Left-click on **ADD NUMBER TO ROLODEX**. This saves the number to your rotary file.
4. In the next screen that appears, type in a descriptive name for the card.
5. Left-click **SAVE** to place the new card in your rotary file or **CANCEL** to exit.

To delete a card:

1. Left-click the thumbwheel on the rotary card file until the card you want to delete appears on top.
2. Select **DELETE FROM ROLODEX** on the card to delete that entry.

To call another player (Master):

1. Flip to the correct card using the thumbwheel.
2. Left-click on the card.
3. Left-click on **DIAL**.

To answer a call (Slave):

1. Left-click the telephone.
2. Left-click **ANSWER VIA MODEM** to wait for a call from the Master player. (Left-click **CANCEL** to quit waiting.)

When the Master calls the Slave, the modems automatically connect. After this happens, both players will see the *Base* screen.

Continue with **Step 3 — Multi-Player Mission Options**, p. 12, which appears if the master goes to the Death Match on Single missions.

*Note that a semi-transparent, rectangular window now appears on screen. See **Chat Window**, p. 14, for details.*

STEP 2C — DIRECT CABLE (SERIAL) GAME

Direct Cable (Serial) Connection

A direct cable connection game connects a Master player and a single Slave player through a serial cable.

To start game / begin play (Master):

1. From the *Multi-Player Connection* screen, left-click the telephone.
2. Select **CONNECT VIA SERIAL CONNECTION** to connect to a Slave player.

To join game (Slave):

1. Left-click on the telephone in the *Multi-Player Connection* screen.
2. Select **ANSWER VIA SERIAL CONNECTION** to connect to the Master player.

Once both the Master and Slave have selected the direct cable (serial) option, the *Base* screen appears. If the Master player then selects a Death Match (Instant Action) or Single mission, the *Multi-Player Mission Options* screen appears.

*Note that a semi-transparent, rectangular window now appears on screen. See **Chat Window**, p. 14, for details.*

STEP 3 — MULTI-PLAYER MISSION OPTIONS

All connection types — Death Match and Single missions only

Once all the players are connected, the Master must select a mission type. If the Master selects a Death Match (Instant Action) or Single mission, a multi-player option dialog box appears on top of the *Base* screen. The Master player changes individual options by left-clicking on the right-hand column (the text cycles through the options listed below).

This pop-up dialog box can be displayed by all players at any time before takeoff.

Alt M	Display *Multi-Player Mission Options* dialog box
Mission Time Limit	Sets the length of the mission (15 MINUTES / 30 MINUTES / 45 MINUTES / 1 HOUR / UNLIMITED).
Friendly Fire Damage	Enables or disables damage to friendly targets (ALLOWED / DISALLOWED).
Player Regeneration	Sets whether or not a killed player can regenerate, as well as how long it will take (NEVER / INSTANTLY / 10 SECONDS / 20 SECONDS / 30 SECONDS).
Regeneration Distance	Sets a radial distance at which a player regenerates, based on where the player died (AT FARP / 0 KM / 2.5 KM / 5 KM / 10 KM).
Shift E	Re-enter game after dying (in Single/Death Match missions)
Rearm/Refuel Frequency	Limits how many times players can revisit a FARP for fuel and weapons (NEVER / ONCE / UNLIMITED).
Weapons Availability	Sets what weapons are available to players (ALLOW ALL / NO HELLFIRES / NO STINGERS / ROCKETS ONLY / GUNS ONLY / RANDOM).

When the Master player sets all options and left-clicks **OK**, the *Single Mission* screen appears, or the Death Match begins.

STEP 4 — BASE SCREEN

All connection types

After your multi-player game (network, TCP/IP, modem or serial) is set up, continue just as you would for a normal, single-player game. Players can fly cooperatively in most mission types (except for in the Tutorial training missions, which are only single-player), and head-to-head in the NTC campaign and Death Match (Instant Action) modes.

Most game options work identically in single-player and multi-player games, with a couple of exceptions:

Instant Action Selecting this option as a multi-player game begins a "Death Match." This is essentially a free-for-all for everyone, with no teams. (In single-player games, this option begins a single-player game against computer opponents.)

Maps: All Missions All players must be using the same map. The currently loaded map for each player displays in the *Multi-Player Game Setup* screen under the *Map* column. The numbers in parentheses indicate a section of a map — AZR (3,0) is a different map than AZR (0,0).

If one player needs to load a different map, his or her name will appear in the text that displays when the mouse passes over the flight helmet. The name of the map required for that mission appears as well. The map will automatically decompress before play begins. All players will have to wait.

If a player needs to load a map, this occurs when the Master starts the mission.

Note: *If the Master player selects an NTC Campaign mission, the Friend/Enemy Setup dialog box appears. Players can fly cooperatively or head-to-head in these missions.* *See p. 21 for details.*

Chat Window

All multi-player games have a chat function. Once you reach the Base screen after connecting, the Chat Window appears near the top of the screen. This is how you communicate with other players who are connected to your game. Anyone that joined the game can talk to everyone else in that game.

Chatting works identically on the base and when you're in flight.

To chat:

1. Press Caps Lock. This opens up a communications channel.
2. Type your message and then press Enter.

   Your message appears in the Chat Window, preceded by your call sign.

   Pressing Caps Lock multiple times cycle through message recipients (All, Team, Wingman, Cockpit Crewmate, Enemies, Target).

   Alt + Caps Lock, Erases all text in Chat Window. If you press it twice, the Chat Window disappears.

To move the chat box:

1. Make sure you're not in chat mode (i.e., you haven't pressed Caps Lock).
2. Press Ctrl Caps Lock.
3. Press again to move the window to another preset position.

You can change or add preset positions for the Chat Window by editing CHAT-MACROS.TXT. This file can be found in the game folder on your hard drive (***Jane's*** ***Longbow 2***).

Detailed instructions for changing the position of the Chat Window appear in the file.

Colors

The color of text in the Chat Window varies as follows:

White	Text that you type, or a message from wingman or cockpit crewmate (pilot or CP/G you're flying with)
Blue	Message from friendly
Red	Message from enemy

You can change any of the above colors by adjusting the RGB (red, green, blue) values in CHATMACROS.TXT. 0,0,0 represents black, and 255,255,255 white. Changing any of the three numbers will change the color of your text. If all values are equal (such as 183,183,183), you'll define a shade of gray.

Detailed instructions for changing colors appear in the file.

Message Macros

You can store up to 48 text messages and send them using the function keys at the top of the keyboard. You can send these messages in flight by using your Chat Window. The Shift, Ctrl and Alt keys control who receives the message.

Caps Lock	Activate Chat Window
F1 through F12	Send macro message to **all**
Shift + function key	Send macro message to **team (all friendly flights)**
Ctrl + function key	Send macro message to **wingman / cockpit crewmate**
Alt + function key	Send macro message to all **enemy flights**

Custom Messages

The messages are pre-defined (see below), but you can change them by editing a text file. (Do so before running *Longbow 2*.)

1. From the *Windows 95* desktop, left-click **START**, then select *Programs/Accessories/Notepad*.
2. Select *File*, then *Open*.
3. Select the game folder (**C:\JANES\LONGBOW2** is the default).
4. Double-left-click on CHATMACROS.TXT.
5. Now, follow the instructions in the file to edit the message text.
6. Select ***File***, then ***Save***.
7. Close the program (select ***File***, then ***Exit***) and start *Longbow 2* to use your new messages.

STEP 5 — MISSION PLANNER SCREEN

All Connection Types

Note: *This section does not apply to Death Match mode (Instant Action).*

As soon as the Master selects a mission type, he or she may select the *Mission Planner*. The Mission Planner options in a multi-player game are almost identical to those of a single-player game, but several options are specific to multi-player play. This section discusses only the multi-player options — for details on the other options, see p. 1.10 in the *Reference Manual*.

Selecting Pilot and CP/G Seats

You select a seat in a multi-player game just as you do in single-player games. If you want to switch into another pilot's seat, however, you must select one that currently has a computer pilot. (If the seat is occupied by a human pilot, that pilot must first unseat himself.)

You can't fly as a wingman in a computer-controlled helicopter flight. Likewise, you can't fly in the CP/G position under a computer-controlled lead pilot. Any violations to these rules must be resolved before you can exit the *Mission Planner* screen.

To switch into a CP/G position, you must first unseat yourself from your current position, and find a helicopter that already has a human pilot. Then, use the Chat Window to ask that pilot to place you in his CP/G seat.

Assigning Mission Planning Tasks

The Master is in charge of hosting a multi-player game, but has only limited control over mission planning. Instead, all responsibilities of mission planning are divided up by team (if it's a head-to-head mission), then by FARP (cooperative missions).

The following sections detail duties for both types of play.

Cooperative Play

Master Player. In cooperative missions, the Master player edits helicopter assignments and loadouts for *any* computer-controlled FARPs. Additionally, the Master edits information for a particular FARP if he / she is flying as the lead pilot of that FARP. (Other players can be lead pilots of other FARPs.)

Team Leader. The Master player acts as the team leader in cooperative multi-player games.

FARP Leader. The FARP leader is in the pilot's seat of the lead helicopter at a particular FARP and determines all helicopter types, loadouts and waypoint data for that FARP, even if other human players are at the same FARP.

Head-to-Head Play

Master Player. In head-to-head missions, the Master player edits helicopter assignments and loadouts for *any* computer-controlled FARPs on his or her team. Additionally, the Master edits information for a particular FARP if he / she is flying as the lead pilot of that FARP. (Other players can be lead pilots of other FARPs.)

Team Leader. In team vs. team missions, each side has a *team leader*, who edits helicopter assignments and loadouts for his or her own FARP. Team leaders also edit data for any FARPs on their side that are completely computer-controlled. The Master is the Team Leader for his or her side.

FARP Leader. The remaining human players in a head-to-head game are sequentially placed in lead pilot seats at the remaining FARPs. (The lead pilot is the person sitting in the pilot's seat of the lead helicopter — not in the CP/G's seat or the pilot's seat in the wingman's helicopter.)

The FARP leader is in the pilot's seat of the lead helicopter at a particular FARP. He or she determines all helicopter types, loadouts and waypoint data for that FARP, even if other human players are at the same FARP.

General Notes

- The Master player is the only one who can close the Mission Planner.
- If the Master player closes the Mission Planner before all leaders **TRANSMIT FARP DATA**, the last data that the master received from each FARP will be saved. Any other changes that were not transmitted will be lost.
- Information for a FARP with at least one human player can only be modified by the lead pilot for that FARP. The FARP leader picks the helicopter types and weapon loadouts for all helicopters at that FARP.
- If a FARP is not computer-controlled, a human pilot must fly in the lead pilot's position. This means that a human player cannot fly as a computer pilot's wingman.
- All players can remove themselves from any pilot or CP/G seat and move into another seat in a different helicopter. (This automatically replaces the empty seat with a computer pilot CP/G.)
- Only pilots can place another player in their helicopter's CP/G seat.

Changing Tasking Window Data

The Master player, team leader and FARP leaders are the only ones that can change data in the Mission Planner's Tasking window. All players, however, can see the Tasking window and all of the information for each FARP.

If the FARP leader starts modifying data for his or her FARP, the text on the summary panel turns red. This lets other players know that the data is currently being changed. Once all information is edited, the team and FARP leaders select **TRANSMIT FARP DATA** from the *System* menu to send the information to all other players.

After all modifications have been made, and all FARP leaders have transmitted their FARP data to other players, the text turns black. (If any changes are made before the Mission Planner is closed by the Master player, however, the text will turn red again.)

The Mission Planner windows on the following pages have multi-player options:

Tasking Window

Players use this panel (shown on facing page) to change their FARP and seating assignments. See **Function Buttons** on p. 1.13 of the *Reference Manual*.

FARP

Each FARP has a leader.

The Master player leads one FARP. Other players are sequentially assigned to remaining FARPs.

If two human players are assigned to the same FARP, then one is in the lead pilot's slot, and the other is in the pilot's seat of the secondary helicopter.

Players can move to and from different FARPs.

See **Assigning Mission Planning Tasks**, p. 17, for player responsibilities.

PILOT AND CP/G ASSIGNMENTS

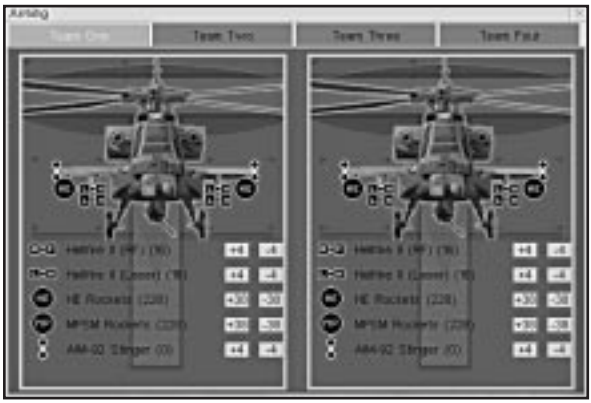
Assign a human or computer pilot to each seat (both the pilot and CP/G slots). Left-click in this field to display a menu. Left-click on the pilot you want.

You cannot place a human pilot as a CP/G if a computer pilot is in the pilot's seat. Only human pilots can pick players to fly in the CP/G seat of their helicopter.

Arming Window

Masters, team leaders and FARP leaders can use this screen to change helicopter loadouts for other human players and computer-controlled flights. This is done in the same manner as arming in single-player missions. (See **Mission Planner** on p. 1.11 of the *Reference Manual*.)

In this option screen, the lead pilot's helicopter appears on the left side of screen, and the wingman's helicopter on the right. (This is exactly as they appear in single-player missions as well.)



System Menu

TRANSMIT FARP DATA (Team / FARP leaders) Left-click this option to send your FARP information to other players.

EXIT (Master) Left-click to end planning and return to the Mission Planning Center. Do not do so until all text in the summary panel appears black. (This indicates that you have the most current information, and that no discrepancies exist.)

Submitting FARP Information

The summary panel text turns red once a FARP leader starts editing information. This lets other players know that the data is currently being changed. After all modifications have been made, and all FARP leaders have transmitted their FARP data to other players, the text turns black.

Once the FARP leader has made all changes to helicopters, loadouts and waypoints, he or she transmits the data to all other players by selecting **TRANSMIT FARP DATA** from the *System* menu. This sends all of the information to all other machines and updates the summary panel (left side of the *Mission Planner* screen).

Once all of the summary text is black on everyone's machine, the Master player can start the mission. (Left-click the red power button to close the Mission Planner, then left-click on the flight helmet.)

- Seating assignments for human players are transmitted in real-time (before the **TRANSMIT FARP DATA** button is pressed).
- Since team leaders are sending information for computer-controlled FARPs as well, their data transmission may take a bit longer.

Starting the Mission

When mission planning is complete and all information has been transmitted, the Master starts the game:

1. Left-click **POWER** from the *Mission Planner* screen.

   Alternatively, select the *System* menu, then highlight **EXIT**.

2. Left-click the flight helmet to start the multi-player mission.

FRIEND / ENEMY TEAM SETUP

Campaign Games Only

If the Master Player selects the Campaign hangar and selects an NTC campaign mission, a screen appears that lists all joined players. All players are initially listed as members of the Friend team. The Master player has (M) after his or her team name (Friend or Enemy), as does the Team leader for the opposing side.

To move players between teams:

1. Left-click on **FRIEND** next to the player's name. (Friend is the team name.) **FRIEND** will change to **ENEMY**.

The first player assigned to the other side is automatically the Team leader. However, the Master can select a different team leader for the opposing team. (The Master must remain the Team leader for his or her team.)

To designate a new Team leader

1. Left-click on **FRIEND** or **ENEMY** next to the current Team leader. (M) will no longer appear after that player's team name.

   Left-click on **FRIEND** or **ENEMY** next to the new Team leader until (M) appears after that player's team name.

IN-FLIGHT MULTI-PLAYER INFO

Before the game starts, please ensure that all players have the same terrain map decompressed. This process can take a while, and players with different maps can slow down the mission load time.

To see which map each connected player has loaded, look at the *Multi-Player Game Setup* screen. If all players have the same map loaded, the Master can select **PLAY GAME** to start the mission.

Note: You cannot use time compression in multi-player games.

In-Flight Tasking

During flight, tasks between human pilots and co-pilot/gunners are divided up as follows. (If you're flying with a computer CP/G, you can set tasks in the **OPTIONS** menu under *Gameplay*.)

CP/G	Pilot
Target acquisition	Piloting
Hellfires, Rockets	Guns

- You can't switch seats with another player once the mission begins.
- The Master player is the only one that can save a multi-player campaign game.

  The saved game game records only what was killed, and how far you've progressed in the campaign — it doesn't remember who flew with you. Since the game stores campaign progress only on the Master's machine, you can fly with different people every time if you want to (as long as you're the Master). When players join a game, the Master's saved campaign game is the one that's loaded.

PFZs

PFZs work identically in single-player and multi-player missions, but the labeling differs slightly.

Now, each PFZ is identified by a player number, followed by the zone number. PF2-3, for instance, was created by Player 2 and was the third PFZ to be created in that mission. If Player 1 then creates another PFZ, it will be labeled PF1-4.

To see the callsign and player number of each connected player, use your COM MFD. The player numbers and names appear at the top of the MFD.

When you hand off targets using Ctrl Bksp (used to hand off targets to wingmen in single-player play), your currently selected target list is transmitted to your entire friendly team. Whatever PFZs you have selected in your TSD will appear on their TSDs as well.

When you receive targets from someone else on your team, your TSD is updated with that PFZ information. If someone else deletes it on their TSD, your display will still show the PFZ. You will need to manually delete it from your TSD — it won't update automatically.

When you are flying with another player in a single helicopter, you can hand off targets and PFZ deletions. All computer-controlled flights with have their TSDs updated with your new information.

Only 16 PFZs can be designated per helicopter. If you already have 10 PFZs and someone hands you 8 more, you'll only receive the first 6.

Dying

If you die in a multi-player Death Match (Instant Action) or Single mission, you can re-join the fight, as long as the Master player has selected a regeneration option.

If you find yourself in a Death Match situation in which your aircraft is too damaged to fly, you can destroy your aircraft and regenerate.

Shift E	Re-enter Death Match in a new helicopter (use when heavily damaged)

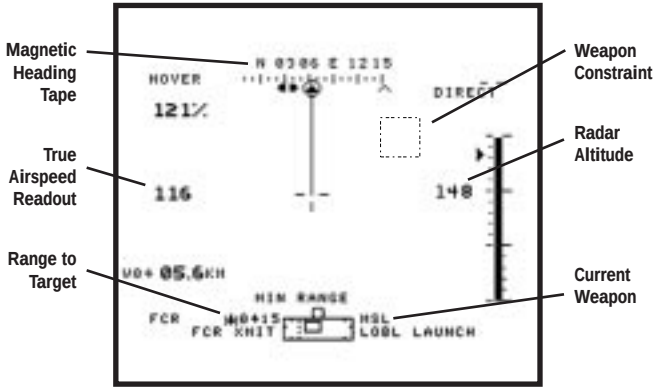
EXITING / DISCONNECTING

Anyone in a multi-player game can exit using the keys listed below. Slave players can disconnect at any time without disrupting the game. However, if the host (Master) player exits, the game ends for all players.

Alt D	**Disconnect** from a game that you've joined (only works before takeoff)
Alt Q	**Quit** the mission
Alt X	**Exit** to Operating System

- You cannot pause a multi-player game.
- Once you quit or exit, you're disconnected from that multi-player game and must make a new multi-player connection before you can join another game.

Cockpit



Alt O **OPTIONS** menu (also Esc during flight)

Targeting / Weapons

T **Target next enemy** object

Bksp Switch **active weapon** to Hellfires/FFARs/Stingers

Manuever the helicopter so that the weapon constraint is directly over the target — when the constraint border turns solid, fire.

No Lock	Weapon	Valid Lock	Use Against
	Hellfire active		Armor
	Stinger active		Aircraft
	FFARs (rockets) active		Targets

Enter **Fire cannon**

Spacebar **Fire rocket/missile**

For More Details

See the *Install Guide* for detailed **Installation Steps.**

See the **back cover of this manual** for basic keystrokes.

See **How to Use** at the front of this manual to find out what's in this manual.

See **In a Hurry?** (p. 0.12) for basic game instructions.